The American Journal of Surgery

EDITED BY THURSTON SCOTT WELTON, M.D.

March 1943

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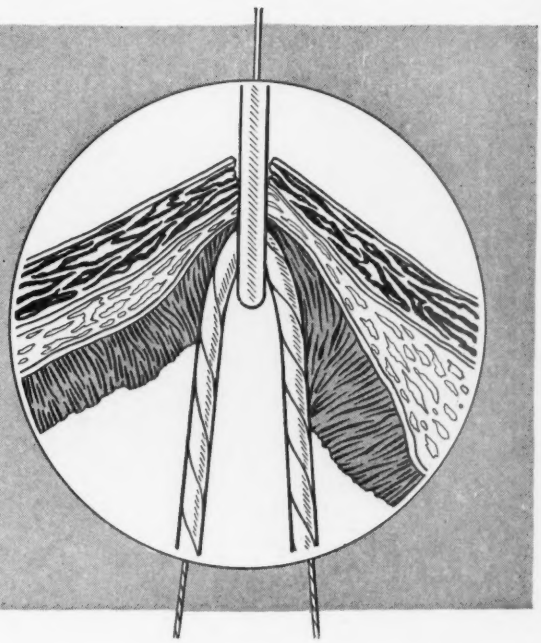

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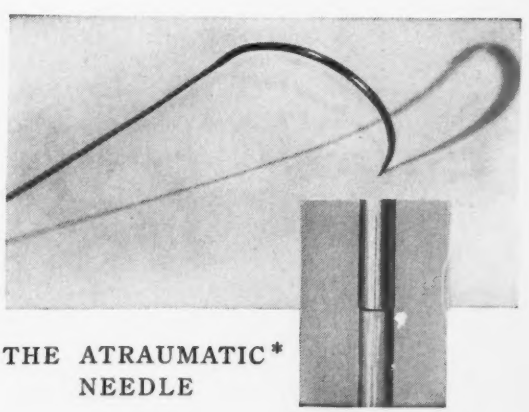

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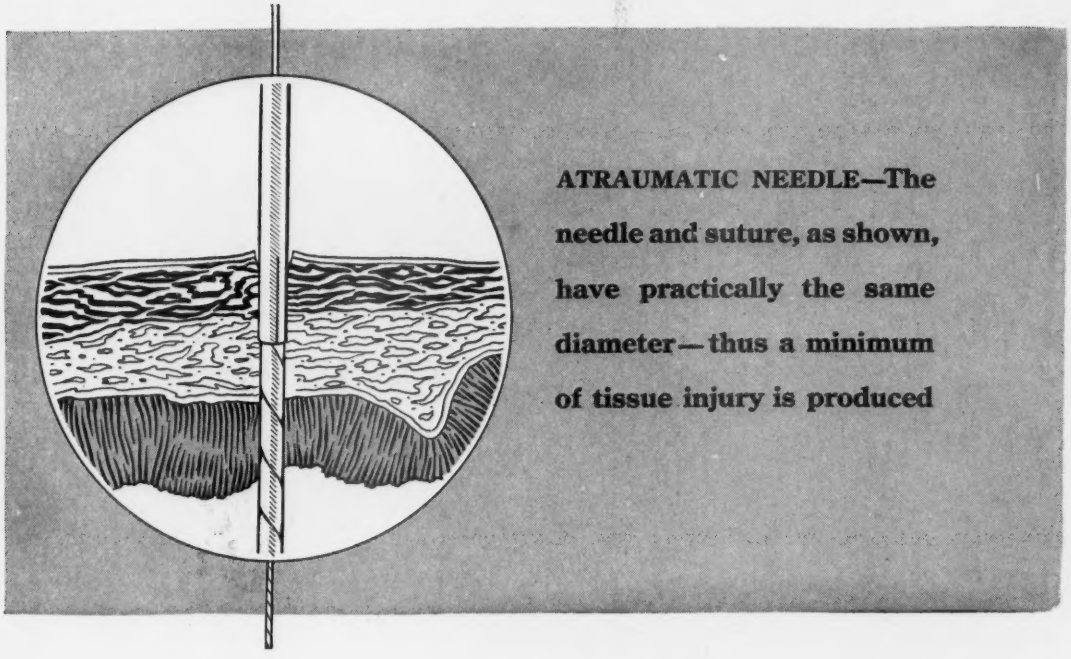

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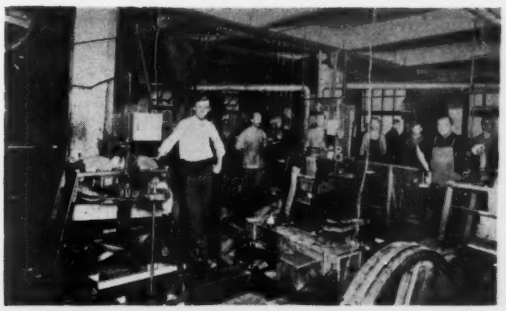

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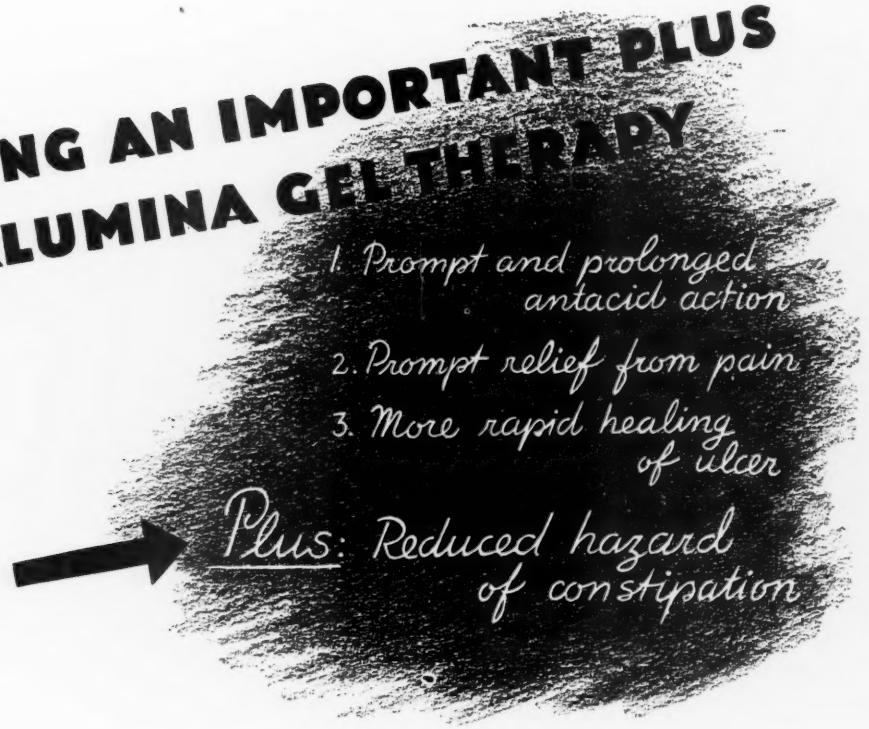
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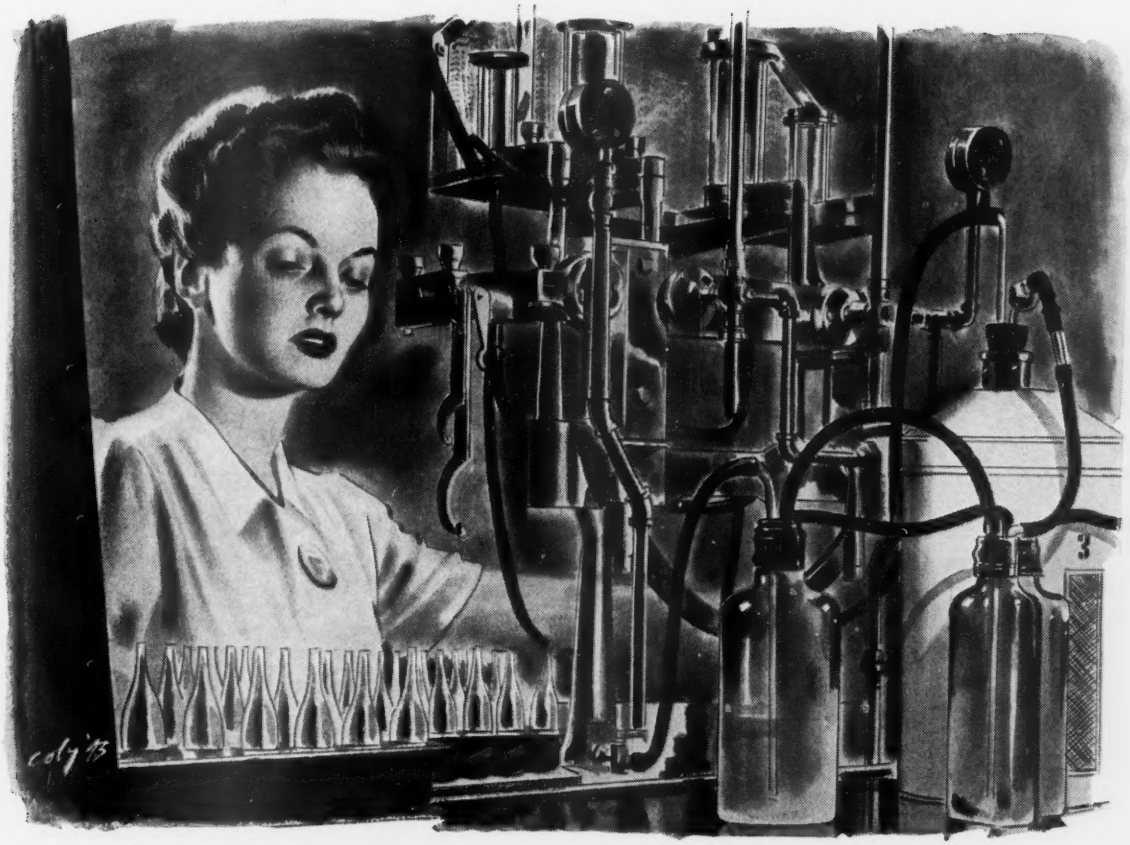

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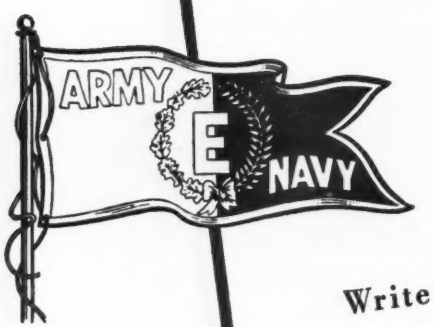

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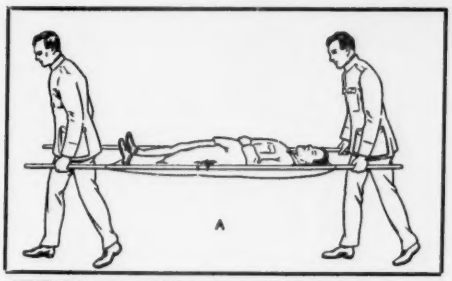

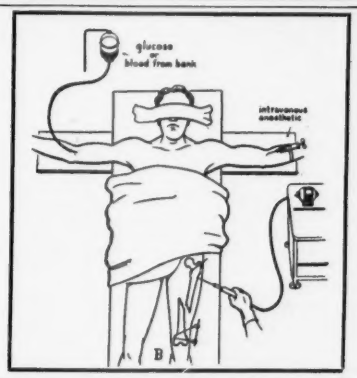

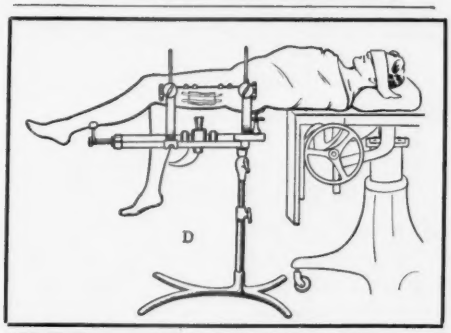

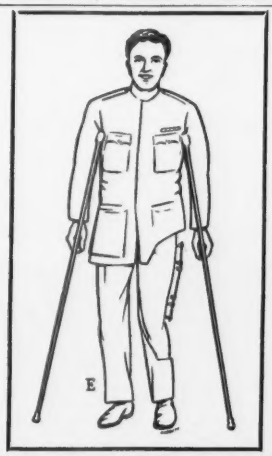

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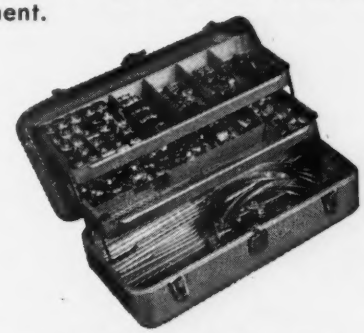

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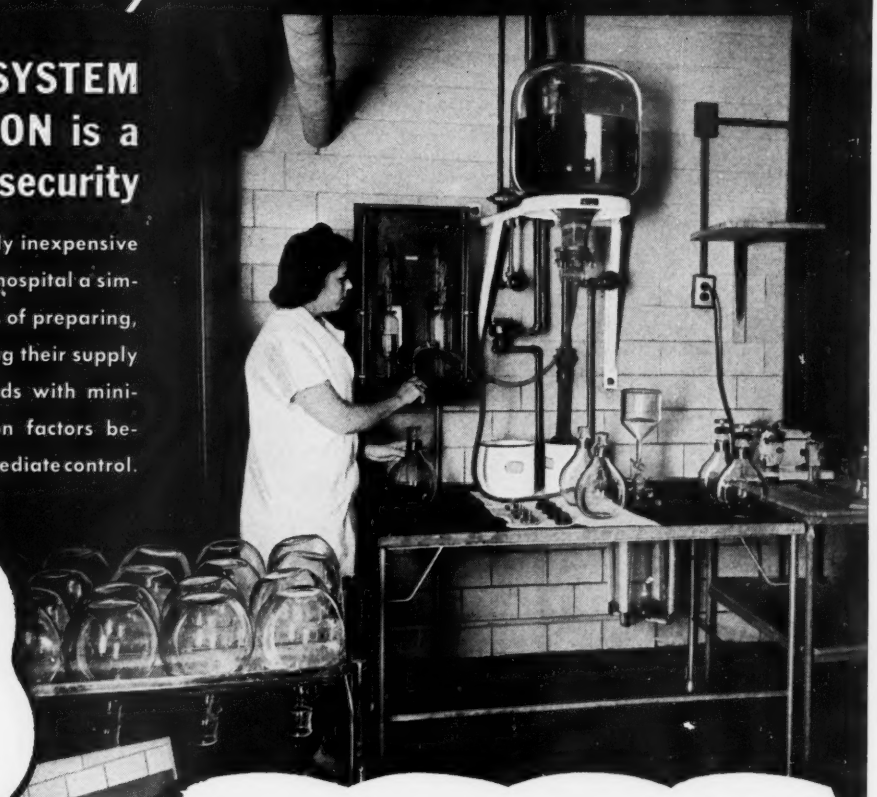

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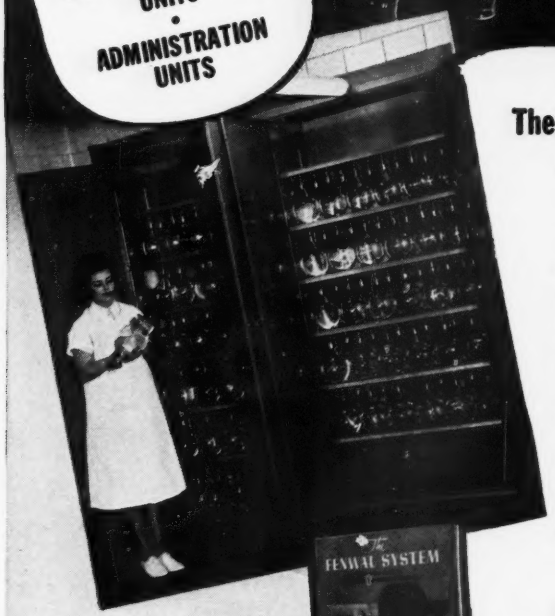

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[1] Hardin, P. C.: Cod Liver Oil Therapy of Wounds and Burns, South. Surg. 10:301, 1941.

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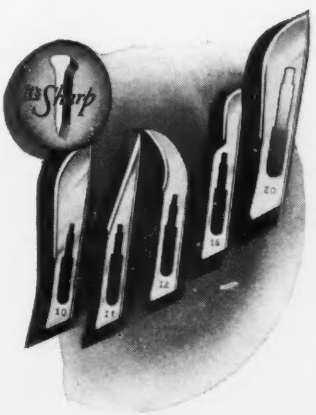

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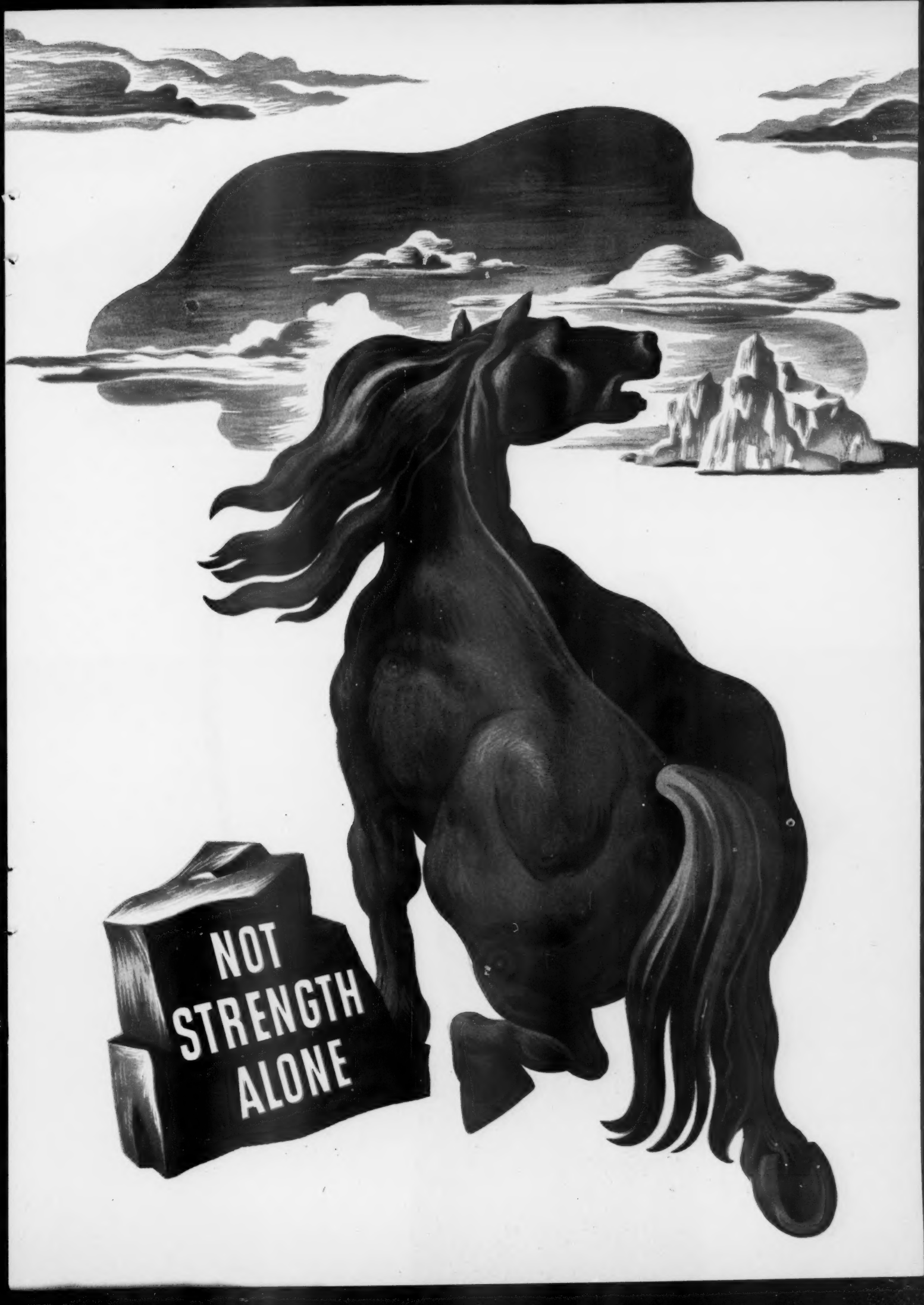
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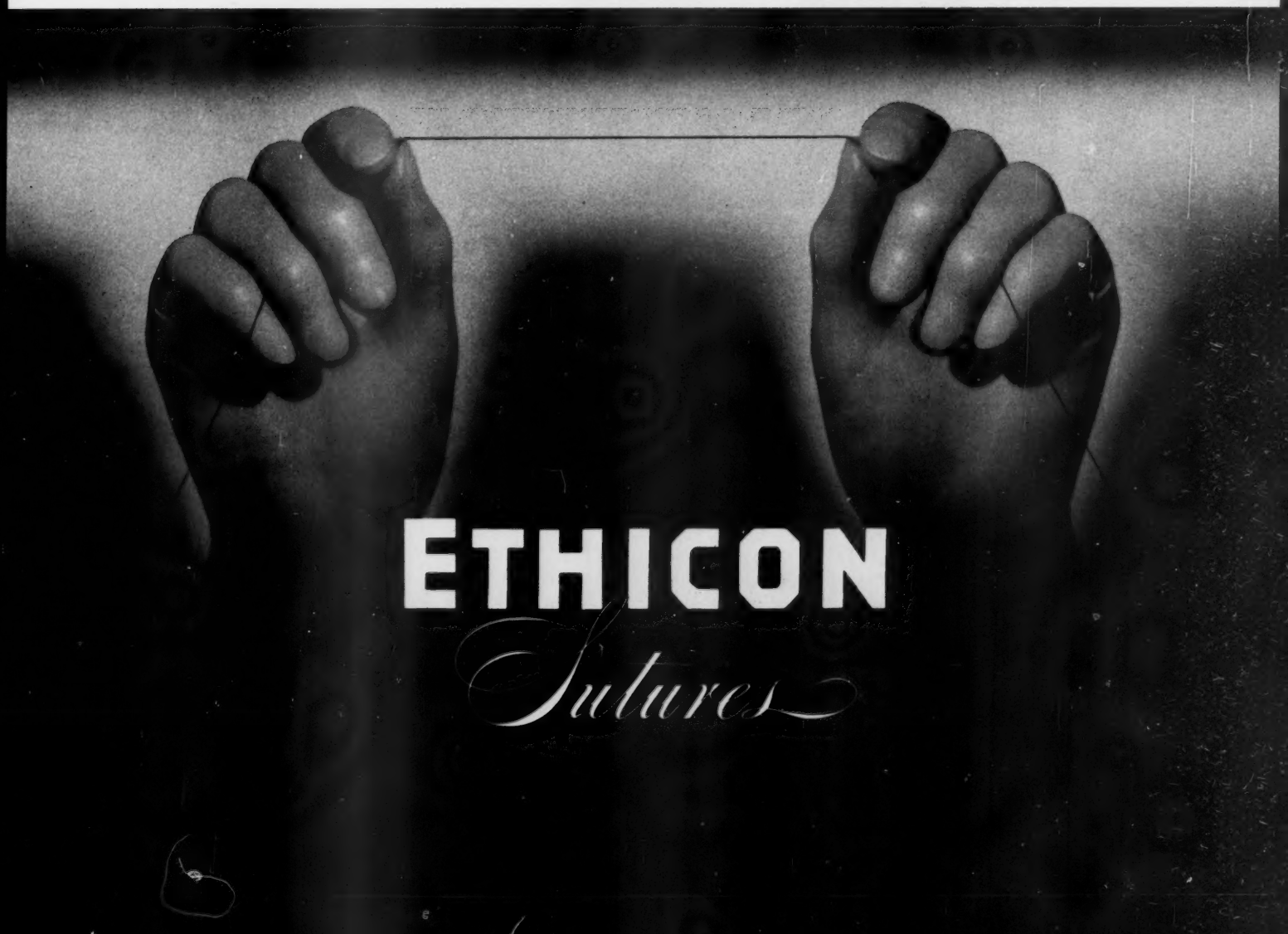

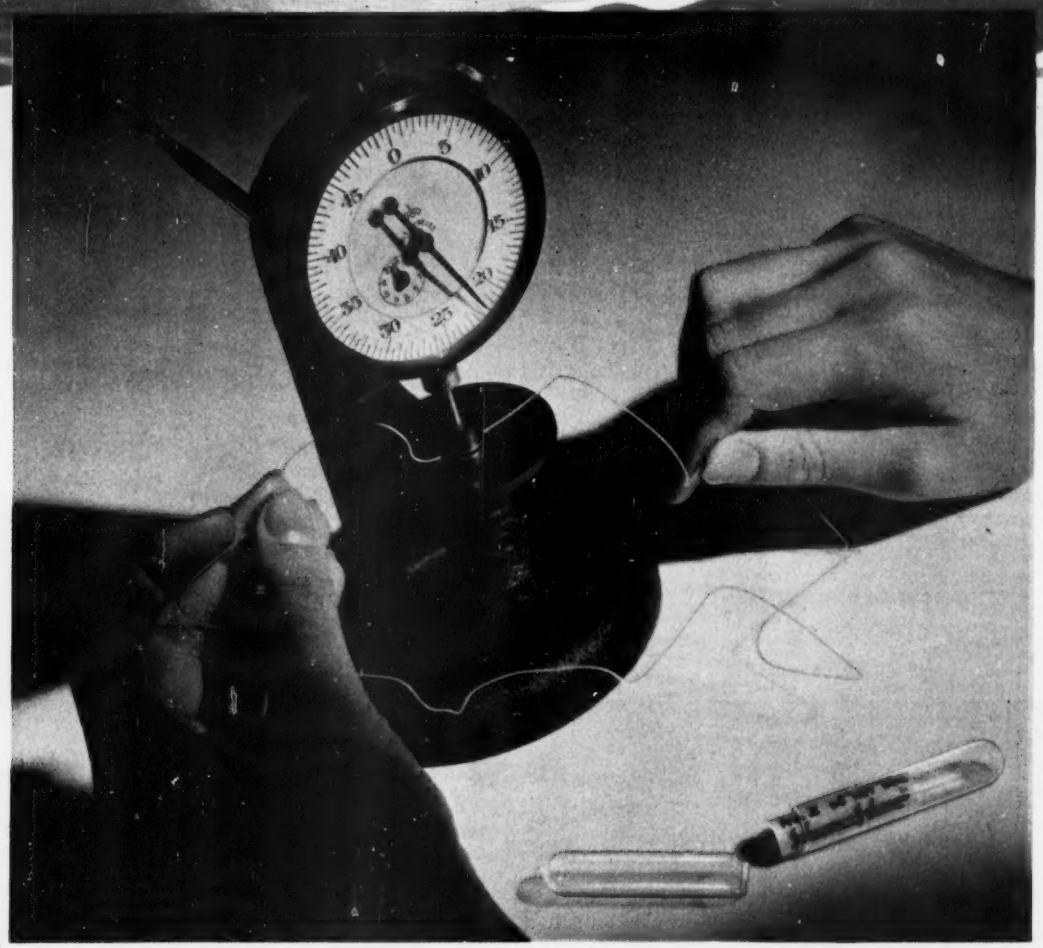

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NEW SERIES VOL. LIX MARCH, 1943 NUMBER THREE

Editorial

THE CANCER SPECIALIST OR ONCOLOGIST

DURING the past three or four decades the complexion of death-dealing diseases has passed through important changes. As everyone knows the improvement in general public hygiene and the control of communicable disease have greatly reduced the death rate under twenty-five years. In other words, a lesser number of people are dying in the first half of life. To this may be added the advances in diagnostic methods and medical and surgical therapeutics. Sociologists tell us that in the United States the control of emigration and birth control are other factors tending to make this country a country of old people. Whereas at the turn of the century the average duration of life in the United States was thirty-five, it is now close to sixty years. All of this means that the problem of controlling diseases has entered a new phase. Most of the deaths that occur today are from diseases developing after middle life. Foremost among these are cardiovascular diseases and second is cancer. These facts force the medical profession to devote more attention to the diagnosis and treatment of these death-dealing scourges.

We hear much nowadays—and rightly so—about the control of infantile paralysis. This is needed, for every year this dreaded disease leaves thousands of children crippled for life. It is astonishing, however, that cancer causes more deaths in childhood than does infantile paralysis.*

Another well recognized fact about medical progress is that medicine and surgery are rapidly becoming much more complicated arts and sciences than in the previous generation. Our increasing knowledge of the human body, its structures, functions and ills, requires a much more complicated system of diagnostic aids and gadgets and therapeutic weapons. All of this progress necessitates a much longer preparation for the practice of medicine and surgery, with emphasis upon specialization after a broad general foundation. Along with this increase in the complications of medicine, the diagnosis and treatment of cancer has likewise advanced. In bygone days, internal cancer was always fatal. The treatment of external cancer was a crude surgical or cautery procedure which perchance ended fairly happily if the disease was taken early. Countless numbers died of internal cancer without proper diagnosis. In recent years, surgery has made tremendous advances. Tumors in the brain, lungs, abdomen are now more frequently diagnosed and treated satisfactorily in the early stages. Operations for these serious conditions "have been made rela-

* Read, Clifton R. Annual Report of the American Society for the Control of Cancer, 22: 9, December, 1940.

tively safe for the patient and the patient is being made safe for the operation." The cautery, always a prominent part of the surgeon's armamentarium from time immemorial, is in many places being replaced by the refined apparatuses and technic of electrosurgery. The advent of radium and *x*-ray therapy are great boons to the cancer sufferer, not only in increasing the percentage of five-year salvages, but also in relieving the advanced cases. He who attempts to treat cancer today must have cognizance of all these therapeutic agents. One of my seniors once said, "Cancer is first to be treated by surgery and if this fails, then by *x*-ray or radium." This man lived to change this philosophy radically. Today each patient with cancer must be studied as an individual problem and the therapeutic agent or agents chosen which are best suited for him. To be able to make a careful selection of one or a combination of more than one of these therapeutic agents requires long and complicated training. Gradually a group of "specialists" have grown up who are cognizant of the intricate problems of cancer diagnosis and the elaborate methods of treatment.

The general trend of specialization must be carefully balanced by fundamental, comprehensive training. Too narrow limitations lead to many pitfalls through short-sightedness. On the other hand, it is impossible for any one man to master all fields. A happy medium must be worked out with time and experience. This is especially true in the realm of cancer therapy; no one man can be proficient in the diagnosis and treatment of all neoplasms widely distributed throughout the body. A prominent surgeon put it bluntly by saying, "No one can remove every kind of a tumor from the brain to the toenails!" Only the foolish would attempt such an inclusive "specialty." However, I can conceive of a type of specialist who is sufficiently well versed in the fundamental principles of neoplastic growth, its diagnosis and treatment, to be helpful in any clinic or large institution in solving many of the therapeutic problems. He need not be a combination of brain surgeon, thoracic surgeon, gastrointestinal surgeon, urologist, gynecologist and radiologist. If, on the other hand, his training has been sufficiently broad by way of general medicine, general surgery, pathology and radiotherapeutics, he can be of value as a consultant in these fields and limit his own therapeutic efforts to a well defined and established specialty. For example: A well trained general surgeon who has studied pathology thoroughly and has had a year or two in radiotherapeutics, can continue as a general surgeon with special emphasis upon the treatment of neoplasms, develop skilled technic in his own field and be of inestimable value in co-operating with his confreres in other domains.

In recent years medical and surgical investigators have delved into physiological problems with far reaching discoveries. Cancer research has followed suit, increasing our knowledge of the behavior of cell growth and its relation to the cancer problem. The influence of hormones on cancer growth in the laboratory animal and patient has been studied with benefit. Just where this will lead is speculative. However, it means that the cancer therapist must keep abreast of these developments and be able to co-ordinate the results of laboratory investigation with clinical findings and make clinical applications of new discoveries when pertinent.

Although the "oncologist" may not be temperamentally able to or by training capable of carrying on highly technical laboratory, biological and physiological experiments, yet by keeping himself familiar with the advances in scientific research he can assist in correlating the work of the investigator and the clinician. In this manner a great service will be rendered the group or institution with whom he works. It is obvious then that in the larger institutions at least the whole cancer problem cannot be settled by one man alone, but the cancer specialist will be on hand to co-operate with a group of workers, including

the laboratory investigator, the pathologist, surgical specialists, readiologists, and at times the internist.

In smaller communities, the cancer specialist perhaps has a greater place to fill. He may be the only one in a small city serving a large surrounding territory, who has had besides his general medical foundation, training in pathology, surgery and radiation therapeutics. It is also important that in these communities, there be a well trained physician who can bring together all efforts, professional and civic, in establishing a program of cancer control, including education of the profession and lay public alike, and furnishing diagnostic facilities and therapeutic opportunities.

After this general discussion, it seems appropriate to make a few suggestions for the education of such persons. I will outline the training for a general surgical oncologist, bearing in mind that in larger cancer hospitals and other institutions, one or more individuals in each department may become especially qualified to manage the patients with cancer in the gynecological, urological or other departments.

In several hospitals in this country departmental cancer clinics have already been established and directed by a well trained physician.

Suggestions for General Surgical Oncologist. (The term "oncologist" is herein used for lack of a better one. It also obviates the somewhat distasteful title of "cancer specialist.")

First year, general internship, including medicine and surgical specialties.

Second year, pathology. Pathological training could be limited to six months, with the other six months devoted to a clinical specialty, thus increasing the general internship to eighteen months.

Third, fourth and fifth years—surgical internship, assistant residency and residency, respectively. Three years in surgery prepares the trainee for the American Board of Surgery, if he wishes to certify in that Board.

Sixth and seventh year—radiation therapeutics. This, of course, should include radium and *x*-ray therapy. With two years in radiation therapeutics and a foundation in pathology, the trainee would be eligible to apply for certification in the American Board of Radiology in radiation therapeutics.

Inasmuch as there is no Board of Oncology, an attempt has been made in the above outline for the trainee to emphasize either surgery or radiation therapeutics, so that he may certify in one of the established Boards. He cannot certify in more than one Board and therefore must choose his preference. It remains to be seen, as time goes on, and experience accumulates, whether an American Board of Oncology is really advisable.

A criticism of the above scheme might be raised as to the length of the training period. However, if one is to understand the cancer problem thoroughly and prepare himself to treat cancer patients in some one of the accepted specialties, six or seven years are certainly not too many.

In recapitulation then, one might say that the cancer specialist, or oncologist, is a practitioner of medicine, who has first of all a well founded knowledge of medicine. Following this he should have sufficient training in pathology, surgery and radiation therapeutics to understand the fundamental problems in cancer diagnosis and therapy. He cannot be expected to master all procedures for the treatment of all neoplasms wherever they may occur in the body. However, after a wide general cancer training he can specialize in some field to his liking and at the same time be of valuable consultatory aid to his confreres. In large general institutions, he can head up the group which operates the cancer clinic. In specialized cancer hospitals, he naturally would fall into a narrower field of one of the already accepted specialties. In smaller communities, as in a general hospital, he can be the leader in the cancer program.

Grant E. Ward, M.D.

Original Articles

TRENDS IN SPINAL ANESTHESIA*

HENRY S. RUTH, M.D. AND D. DWIGHT GROVE, M.D.

Professor and Head of the Section of Anesthesiology, Hahnemann Medical College and Hospital of Philadelphia

Fellow in Anesthesiology, Hahnemann Medical College and Hospital of Philadelphia

PHILADELPHIA, PENNSYLVANIA

THE development of spinal anesthesia had its inception in a series of uncorrelated discoveries. From the time of the ancients, particularly Hippocrates and Galen, a few anatomical facts were known concerning the cerebrospinal nervous system. Cotugno discovered the presence of the cerebrospinal fluid in 1764.[1] Magendie was the first to show adequately that a section of the anterior roots of the spinal cord affected motility but not sensation, and the reverse was produced by severing the posterior roots. Thus he completed the work of Bell who had merely observed that the posterior roots could be cut "without convulsing the muscles," and a mere touch of the anterior roots caused convulsions.[1] This so-called Bell-Magendie law was confirmed in 1831 by Johannes Müller.[1] The cerebrospinal circulation was investigated and described by Magendie in 1842.[2] In 1851, Claude Bernard observed the results of cutting the sympathetic fibers of the nervous system.[1] In 1853, Pravaz published his original description of the first hypodermic syringe, which was improved shortly afterward by Alexander Wood in the same year.[3]

Cocaine, the active principle of erythroxylin coca, was known since ancient times by the South American natives under the name of the "divine plant of the Incas." Dr. Roy L. Moodie has reconstructed an artist's conception of an early surgical operation among the Incas, showing a blanket-clad native using the cautery to make a cruciform incision in the scalp of a woman suffering from melancholia. The operator chewed a cud of coca leaves, the juice from which would be dropped upon the wound if the pain became severe.[4] "Schezer obtained some of these leaves when on his scientific voyage around the worlds in the Austrian frigate, Novar, and observed that the leaves numbed the tongue when chewed. Gadecke, in 1855, isolated the alkaloid of the leaves and named it 'erythroxylin.' Niemann, in 1860,[5] obtained the alkaloid from them in a pure form, which he named 'cocain,' and also reported the numbing effect of this drug on the tongue; but no attention was paid to his discoveries. Indeed, Bennett, in 1874, demonstrated anesthetic properties of the drug without exciting notice, and four years later, van Anrep, after making a thorough investigation of the drug, could not arouse any interest in it, although he injected it hypodermically into himself. After noting that anesthesia lasted thirty-five minutes, he suggested that it might be used as an anesthetic for surgical purposes. In fact, in 1880, a British medical commission investigating this drug reported that it had no medical

* Presented before the Sesquicentennial Celebration of the founding of the Connecticut State Medical Society, Middletown, Connecticut, June 3, 1942. From the Department of Anesthesia, Hahnemann Medical College and Hospital, Philadelphia.

value and was a poor substitute for caffeine."[6] It was not until 1884 that Carl Koller, an ophthalmologist, introduced cocaine as a local anesthetic agent and demonstrated its qualities in the eye.[5]

Dr. W. S. Halsted[7] in the winter of 1884–1885, freed the components of the brachial plexus imbedded in a cicatricial mass after injection of the roots of the plexus in the neck with cocaine. This operation was performed in a large tent on the grounds of Bellevue Hospital, "having found it impossible to carry out antiseptic precautions in the general amphitheater at Bellevue where numerous anti-Lister surgeons dominated and predominated." Halsted has received much of the credit as the prime mover of the cocaine investigation, initiating his contributions within a week after receiving the publication of Koller's first paper on cocaine, and which appear to have definitely established the principle of nerve blocking by regional anesthesia.

In the fall of 1885, Corning[8] published his first work on the action of cocaine on the spinal cord. As a neurologist, he was primarily interested in local medication of the cord and medical relief of pain, and not in the production of surgical anesthesia. Quoting Corning's original article, "I decided to inject the anesthetic between the spinous processes of the lower dorsal vertebrae. I was led to resort to this expedient from the knowledge of the fact that in the human subject numerous small veins run down between the spinous processes of the vertebrae and entering the spinal canal join the more considerable vessels of the plexus spinalis interna. From these theoretical considerations I reasoned that it was highly probable that, if the anesthetic was placed between the spinous processes of the vertebrae, it (the anesthetic) would be rapidly absorbed by the minute ramifications of the veins referred to, and, being transported by the blood to the substance of the cord, would give rise to anesthesia of the sensory and perhaps of the motor tracts of the same. . . . I therefore anticipated a more or less local action of the drug upon the cord." He then injected 20 minims of a 2 per cent solution of the hydrochlorate of cocaine into the space situated between the spinous processes of two of the inferior vertebrae of a young dog. Five minutes later, he noticed inco-ordination and weakness of the hind legs and, subsequently, decreased sensitivity which persisted for a considerable length of time. His second reported experiment was the injection of 30 minims of a 3 per cent solution of the hydrochlorate of cocaine into the space between the spinous processes of the eleventh and twelfth dorsal vertebrae of a patient. After a lapse of six to eight minutes without symptoms he again injected 30 minims of the solution at the same spot and in the same manner. In about ten minutes the patient complained that his legs "felt sleepy," after which Corning confirmed the impairment of sensibility in the lower extremities of the lumbar region, the penis and the scrotum. He followed this by the painless passage of a sound which, on former occasions, had produced considerable distress. He concludes, "Whether the method will ever find an application as a substitute for etherization in genito-urinary or other branches of surgery, further experience alone can show. Be the destiny of the observation what it may, it has seemed to me, on the whole, worth recording." Corning definitely does not mention spinal puncture in his report and whether he accidentally punctured the dura or whether his results were obtained through an epidural injection may never be factually proved.

In Corning's second report,[9] it is evident that the injection of cocaine within the dura was not proposed by him at this time, for he elaborately describes an apparatus by which he made certain, by measurement of the distance from the skin to the posterior surface of the transverse processes, that the "foramen vertebrae" would not be entered during his injections. He

experimented with this principle of medication as a potent means of treating certain derangements of the spinal cord. The results cited on four human patients adequately demonstrate that he did not produce spinal anesthesia during the experiments alluded to in this second report. Prophetically enough, however, he concludes by trusting that his "long discourse may prove not without practical results."

As early as Corning's time there appears to have been some knowledge of the toxicity of cocaine, for in Corning's second series of experiments, he decreased the concentration of the injected drug from 3 per cent to 1½ per cent. Although of great significance, Corning's procedures remained little more than physiological experiments until a later period. In the meantime, in 1891, Quincke[10] demonstrated the feasibility of spinal puncture as a diagnostic procedure, but did not suggest its application to spinal anesthesia. As a result of the search of a drug possessing less toxicity than cocaine, Giesel isolated tropacocaine from the leaves of the Java coca plant.[5] The alkaloid of this drug was synthetically prepared by Lieberman in 1892.[11] Also, in 1897, beta eucain was discovered. Ziemssen[12] appeared to be the first individual to propose the use of local anesthetics by means of lumbar puncture. According to Dogliotti,[13] Corning, in 1894, advocated in his book[14] the insertion of a large needle into the intervertebral space, then the insertion of a finer needle through the first, and puncturing the subarachnoid space. Here, then, it would seem, rests the origin of the so-called fascia needle or "thumbtack" rather widely used today. Sicard,[15] in 1898 and 1899, experimented with many substances injected by means of lumbar puncture. These works led up to the real event of August Bier,[16] of Kiel, Germany.

This famous surgeon, on August 16, 1898, found it necessary "to amputate a foot in a tuberculous patient who had already undergone several procedures under anesthesia. Bier conceived the idea of injecting 3 cc. of a 0.5 per cent solution of cocaine into the dural sac. The result was startling, the patient having complete anesthesia of both lower limbs for over an hour, followed by some vomiting and a mild headache for twenty-four hours. The convalescence was complete, to the justified gratification of Bier and his assistants.

"After having used spinal anesthesia successfully in six cases without any complications, Bier decided to have a spinal anesthesia tried on himself. He had his assistant, Hildebrandt, inject 2 cc. of a 1 per cent solution of cocaine into the dural sac. Hildebrandt, not to be outdone by his chief, had the same done to himself. The anesthesia was highly satisfactory, but the intolerance of the two celebrated surgeons was much more than that of their patients. They were confined to bed nine and four days, respectively, with vomiting, severe headaches, and marked vertigo. After this period of time they returned to normal, but their personal experience by this method was of infinite value. Bier gave a marvelous description of spinal anesthesia, bringing out its good points and at the same time its defects."[13] After these careful observations, Bier himself asserted that the spinal route should not be acceptable for the production of spinal anesthesia until some substitute for cocaine free from its disagreeable by-effects could be found.[17]

Tuffier of France,[18] however, took up the torch and became the most pronounced advocate of the method at this period. He gave brilliant demonstrations before the crowded audience that came from all parts of the world to attend the Thirteenth International Medical Congress held in Paris during the summer of 1900.[7] It was Tuffier's work that aroused the interest of American surgeons.

Little attention has been given in the literature to the first application of spinal anesthesia in America, due to the fact

that the surgeons, Tait and Caglieri of San Francisco,[19] who initially administered it, were not the first to report their work in the literature. On October 26, 1899, they performed an osteotomy of the tibia under spinal anesthesia, using 1 cc. of a 0.75 per cent solution of cocaine. The patient was slightly passed middle age and the operation was apparently successful, without pain or discomfort. An analogy may be drawn between the application of inhalation and spinal anesthesia in this country in that the first report of each was recorded by persons other than the ones who actually performed the initial application.

The first report of the administration of spinal anesthesia for surgery in America appeared in the Journal of the American Medical Association under New Orleans in Medical News.[20] Under the caption of "Spinal Cocainization," this report reads, "The Bier method of intraspinal cocainization was applied successfully in the Charity Hospital, here, on December 18, by Dr. Matas, assisted by Drs. F. A. Larue and H. B. Gessner, and Mr. Allen, interne. The patient, an Argentine *mestizzo* of 32 years, suffering from internal hemorrhoids, ulcerated, bleeding and excessively tender, had albumin and casts in the urine. A needle having been introduced in the median line, between the fifth lumbar vertebra and the sacrum, the entrance of the needle into the canal was readily confirmed by the escape of cerebrospinal fluid. Two doses of 1 per cent normal salt solution of cocaine hydrochlorate, each of 1 cc., were injected five minutes apart. Nineteen minutes after the first, an internal hemorrhoid was clamped, a groove made around it with scissors, and a ligature applied, and, following this, the distal portion was snipped off; all of this absolutely without any pain. Anesthesia of the lower extremities, the penis, scrotum, and perineum, the abdominal wall, the chest and, in fact, the entire body below the neck, lessening in a degree, however, from below up, was subsequently observed. The procedure was followed by the usual chill, fever to 103.4°F., nausea, occipital headache. Prof. Matas had previously—November 10—applied the method in the case of a colored man, aged 23 years, suffering from a tuberculous knee-joint: 1 cc. of a solution of eucain B, in two doses, was injected through a needle between the first and second lumbar vertebrae. Although the entrance into the canal was confirmed by the escape of cerebrospinal fluid, followed by the usual systemic reaction, no anesthesia was produced, the quantity of eucain being perhaps insufficient." An interesting commentary may be made in that the interne, Dr. Carroll W. Allen, who assisted Dr. Matas, subsequently contributed a textbook on local and regional anesthesia.[21]

In his very complete article in the Philadelphia Medical Journal,[22] Doctor Matas states, "The simple fact that so many experienced surgeons the world over have accepted the new and yet unproved methods of spinal cocainization as a substitute for the general anesthetic is the best proof of dissatisfaction in existing conditions, and is a practical admission of the fact that there is still much room for improvement. The danger now lies in the other direction. In our efforts to escape from the dangers of Charybdis, we are running into the perils of Scylla; and it is not unlikely that we shall witness a repetition of the same errors which so disastrously characterized the early history of cocaine anesthesia and which threatened for a time to bar it out of the field of general surgical practice. The wave of enthusiasm which is at present sweeping over this country will undoubtedly furnish the necessary data needed to form a true estimate of the possibilities and the limitations of the method. But at what cost we cannot tell. In the meantime, the general anesthetics will remain as they must ever with us; if not in the present form, in some other and in spite of their dangers and disadvantages, because unconsciousness in surgical opera-

tions is still a desideratum in many interventions if only to abolish the psychic pain which at times cannot be prevented by the most complete analgesia. At this moment a wave of curiosity blended with enthusiasm is sweeping over the entire country, and almost every surgeon is impatient to try or he has tried to report the 'new method.' It is not likely that communications bearing upon less brilliant methods which require time and much patience to acquire will be received with special favor."

Matas had the foresight to condemn both the injections into the dorsal and cervical portions of the spinal canal and the use of larger doses than those prescribed by Bier and Tuffier. Again quoting Matas, "Special attention must be given to the exact dose of cocaine injected and to the aseptic preparation of the solution. Bier, in the first cases operated from August 16, 1898, to April, 1899, used 2 cc. of a 1 per cent solution. He never exceeded 15 mg. Tuffier, whose experience with the method is greater than that of any other operator (130 cases up to September, 1900), invariably uses a 2 per cent solution of cocaine, of which he injects 1 cc. The total dose, he insists very correctly, should never exceed 15 mg. In my own practice I began by using 1 cc. of a 1 per cent solution of eucain B. after the flow of cerebrospinal fluid had been clearly demonstrated; the needle, with the syringe attached, was left in situ pending observation of the anesthetic phenomena; after ten minutes' delay, as there was no anesthetic effect, another cubic centimeter was injected, and the cannula was withdrawn. Absolutely no effect followed. It would appear from this experience that eucain B. in the same doses as cocaine is absolutely inefficient." Matas further states that care must be exercised to avoid any unnecessary loss of cerebrospinal fluid, as serious accidents had followed excessive drainage in several cases. Bier himself was made quite ill from this cause when the method was tried on himself. At this period in the development of spinal anesthesia, the main interest centered upon the proper method of accomplishing spinal puncture, at what location it should be performed and upon the toxicity of cocaine.

About this time, another factor mitigated against the continued popularity of spinal anesthesia. Corning,[23] Kummer, and others discovered that cocaine anesthesia can be indefinitely prolonged by arresting circulation in the anesthetized area of the extremities by using circular elastic bandages.[5] Braun, who had already published his work on the toxicity of cocaine (1897),[5] in 1901 introduced the use of adrenalin,[24] the chemical tourniquet, and the elastic tourniquet was abandoned.[5] By rendering nerve block or conduction anesthesia, as it was then termed, safer than prior to the use of epinephrine, the popularity of peripheral nerve block increased over spinal anesthesia. Matas himself entered a most logical plea for the use of regional anesthesia over spinal because of the fatalities and complications encountered with spinal anesthesia. After careful observations, Bier himself asserted that the spinal route should not be acceptable for the production of spinal anesthesia until some substitute for cocaine free from its disagreeable by-effects could be found.[7] In a rather large collection of reports on spinal anesthesia in 1900 in the Philadelphia Medical Journal, many surgeons reported their enthusiasm for the use of spinal anesthesia, but every report included discouraging aspects. Due to these complications many surgeons lost all interest in spinal anesthesia. The wave of criticism was further increased by attempts to anesthetize the whole body under spinal anesthesia. An outstanding example of the radical nature with which spinal anesthesia was applied may be cited by the work of LeFilliâtre in the years 1902 to 1904.[24] With his technic, the patient was placed in the sitting position, and he withdrew from 10 to 30 cc. of cerebrospinal fluid, the amount depending on the height of anesthesia desired, the maximum quantity when anesthesia of the

head was to be instituted. Varying amounts of 1½ per cent cocaine were then injected by barbotage. By his method of barbotage, this intrepid surgeon made the injection, allowed the 3 cc. syringe to refill to its capacity, reinjected, and repeated the procedure three or four times. Others injected as high as the sixth cervical interspace. One does not marvel that such methods produced disastrous results which, together with the toxicity of cocaine, were responsible for the very marked decline in the use of spinal anesthesia in the years of 1903 and 1904. At this time the method apparently suffered its first period of real unpopularity.

Condemnation of the use of cocaine continued, and the search for less toxic agents was again stimulated. In 1904, Fourneau,[24] a Frenchman, synthesized a new compound which he termed stovaine after the English translation of his own name. The new drug was less toxic and more stable than cocaine and its advent re-awakened some interest in spinal anesthesia. Our former acquaintance, Tuffier, Reclus and other French surgeons received it with enthusiasm. Babcock,[25] of Philadelphia, studied spinal anesthesia in France and began using it in his surgical service in Philadelphia. Later, he contributed to its safety by emphasizing the value of mouth-to-mouth resuscitation. Another impetus was provided in 1905 when Einhorn,[26] a German, synthesized novocaine. Although this drug is the least toxic of spinal anesthetic agents in use at the present time, its comparative innocuous nature was not fully recognized for many years. After a few trials with novocaine, the pioneers of subarachnoid block returned to the stovaine. Some surgeons used tropacocaine.[11] In the same year, Dixon[27] published his studies on the selective activity of local anesthetics upon the sensory and motor nerve fibers, showing that the sensory components succumbed to their action more rapidly and in lower concentration than do the motor.

In spite of being provided by newer drugs of lesser toxicity, too little as yet was known of the mode of action of spinal anesthesia for it to regain all of its former, original popularity. Sudden extensions of anesthesia after injection and unexplained fatalities were reported. A few, however, were still not disturbed. Barker,[28] an Englishman, in 1907, attempted to control the level of anesthesia produced by spinal methods by a formula which used stovaine as the drug and increasing the specific gravity of the injected solution by means of 5 per cent glucose. Experimenting with such a solution he apparently was the first individual to recognize the importance of the normal spinal curves in their effect upon the ultimate location within the spinal column of the injected solution when dealing with hyperbaric or heavy solutions. Chaput[24] attempted similar results with stovaine, increasing the specific gravity of the solution with 10 per cent sodium chloride. His results, however, were not as successful. Jonnesco, a Roumanian surgeon, in 1908, believed that he had a new and novel method of producing anesthesia for various levels by shifting the level of the spinal puncture. He also advocated the addition of strychnine to the injected solution, believing it to be a stimulant to the spinal nerves. In 1910, he toured the United States in an effort to popularize the method. Unfortunately, he, at times, failed in accomplishing high spinal puncture and the instances of sudden respiratory collapse were too frequent.

During this second period of decreasing popularity of spinal anesthesia Babcock[24] advocated his hypobaric or lighter-than-spinal-fluid solution. This consisted of stovaine in distilled water, the strychnine first advocated by Jonnesco, lactic acid to maintain the stovaine in solution, and the addition of alcohol to reduce the specific gravity. He further believed that the alcohol was of value in aiding sterility of the solution.

Essentially, perhaps, the lack of knowledge of the fundamental principles of spinal anesthesia caused the second period of

minimal use of spinal anesthesia in this country from 1910 to 1920 in spite of the provision of safer agents and further experimentation already mentioned. The dangers of spinal anesthesia, poorly understood as it was at that time, were further emphasized by the comparative safety of the then more or less standardized open drop ether technic in spite of the remote dangers and complications of the latter method. Criticism of spinal anesthesia in this interval reached its peak. The late great John B. Murphy, who had originally hailed spinal anesthesia with some enthusiasm, was now so antagonistic to the method that he suggested that it be prohibited by law.[29] During this period, European surgeons employed spinal anesthesia to a greater extent than in this country due, perhaps, to the contrasting attitude shown on the continent toward free patients and also because inhalation anesthesia was not as well understood in those countries as here. The repercussions of the fear of spinal anesthesia generated during this decade are still encountered all too frequently today.

According to Blumfield and McCardie,[30] the death rate at that time was estimated at 1 to 800–1000, which was considerably higher than with inhalation. Headaches appeared in 33 to 50 per cent of instances, backache in 30 per cent and abducens paralysis was frequent. He concluded "that spinal analgesia is retrogressing in favor and is generally only used when there is marked contraindication to inhalation anesthesia and local anesthesia is not possible. In the treatment of emergencies from spinal analgesia one does wrong whether one sits up or inverts the patient—in the one case he may die of syncope and in the other of poisoning."

An additional commentary on the use of spinal anesthesia of the period has been expressed by Pitkin:[31] "When I started using spinal anesthesia in 1912 its use was confined to very elderly people, those considered as 'bad risks' and to whom we were afraid to give ether. In those days we knew little or nothing about blood pressure changes, and our only concern was whether we had anesthesia—we used to marvel at the fact that we had such nice dry wounds." Of late, the profession realizes that the spinal method is frequently the ideal anesthesia for the young robust individual and many times is contraindicated in the individual of poor physical status.

Labat,[32] too, states that "in 1920 the prejudice against spinal anesthesia was so great that grave concern was considered before spinal was given. Between the years of 1913 and 1921 interest in the subarachnoid block seemed to have been declining all over the world except in 1919 which was particularly rich in foreign publications. In the United States three articles only were published in 1921."

Labat[33] was largely responsible for a sudden increase in popularity of spinal anesthesia beginning about 1920 which has continued to the present time in only slight variations of enthusiasm. His teachings included three factors essentially, two of which had value. His first, the recommendation to employ neocaine, has been subjected to just criticism, as the drug proved to be nothing more than procaine in a French ampule. His two suggestions of value rested in the barbotage technic and the compulsory use of the Trendelenburg position. By barbotaging the solution of procaine crystals dissolved in spinal fluid, the specific gravity of the injected solution was so reduced that it approached isobaric levels. (By isobaric is meant a specific gravity approximately that of spinal fluid.) Subsequently, when he placed the patient in Trendelenburg position there was but little spread of the anesthetic solution cephalad. The Trendelenburg position had value in facilitating through gravity the blood supply to the cerebrum. Labat, in one statement[34] claims to have used the Trendelenburg position since 1916. Later[32] he states, "Our first demonstration in the United States of the use of Trendelenburg position after spinal injection of a simple solution of neocaine dissolved in the

cerebrospinal fluid was given on October 20th at the St. Mary's Hospital of the Mayo Clinic." Despite these discrepancies in time, Labat's teachings did much to establish a recrudescence of spinal anesthesia.

By 1924, increasing concern was being expressed over the fall in blood pressure initiated by spinal anesthesia. Little could be accomplished to combat it save the Trendelenburg position advocated by Labat. In 1924, the active principle of ma huang, ephedrine, was introduced by Chen.[35] Originally, its use was reported by him in experimental shock and hemorrhage. In 1927, Ockerblad and Dillon[36] suggested its use as a protective agent to combat the extreme blood pressure fall of spinal anesthesia. Again, a wave of overenthusiasm threatened the use of ephedrine in that excessive doses to the point of disorganization of cardiac conduction and fibrillation were employed by some. The reaction against the use of ephedrine was led by Labat who expressed the belief that through its action of vasoconstriction in the unanesthetized area the blood supply in that area was further decreased. As a result of experimentation and clinical application the use of vasoconstrictors is well established today, and additional drugs such as neosynephrine, paredrinol and others have been provided, although in general, with the exception of ephedrine, they may be considered as still being in the experimental stage.

In 1928, Pitkin[31] provided a new impetus to spinal anesthesia through his writings. Although his solution of procaine, which he termed "spinocain" is but little used today, and his technic in general is followed but rarely, his publications at the time were indeed well received, and served to focus further attention on subarachnoid block.

Since 1930, spinal anesthesia has enjoyed a period of stability in popularity, more or less confidence in its action and more logical application than prior to this period. This attitude has now been accomplished by the greater knowledge now possessed concerning the many factors involved, which knowledge has been derived from both experimental and clinical data.

Some of the aspects which are better understood and consequently better managed, and some of the more recent outstanding contributions may be briefly epitomized as follows:

Selection of Patients. Certain patients do not do well under spinal anesthesia. It is not necessary nor particularly advantageous for certain surgical procedures. Complications such as severe anemias, shock, particularly from hemorrhage, and others should preclude its use. These factors are well understood, and usually are not ignored, to the advantage of the present popularity of the method.

Preanesthetic Sedation. Psychic reactions are controlled to a large extent by the individualized administration of drugs to the degree of sedation desired. Morphine is employed for its analgesic and hypnotic qualities, atropine or scopolamine because they possess the ability to depress certain reflexes, and the short acting barbiturates to increase the hypnosis. Through the preoperative use of the above drugs, the patient is rendered more comfortable and safe during the operative period, although excessive degrees of central depression should be avoided. No hesitation is shown in administering additional doses when indicated; ofttimes the intravenous route is employed for such supplementation.

Anesthetic Agents. Metycaine, pontocain and nupercaine are the more popular of the newer drugs. The pharmacological action of each is well understood, and due allowance should be and is usually made for their property of increased toxicity. Their outstanding contribution has been through greater duration of action as compared to procaine.

Technics. Standardization of uncomplicated technics has been well described by Lundy, Tovell and others. By these comparatively simple technics, control over the height of anesthesia is readily attained in most instances, and the anesthetization of

excessive and unnecessary areas avoided. Control of prolonged anesthesia of the upper part of the abdomen has been gained by the elaboration of the older technics employing solutions of lighter or heavier specific gravity than that of spinal fluid, through the contributions of Sise,[37] Jones,[38] Etherington-Wilson[39] and others. The effect of position and the presence of the normal spinal curves have also been well described.

Care of Patient during Anesthetic Period: Oxygenation. Mainly through the contribution of Waters and Seevers, the prevalence and the ill effects of oxygen want under spinal anesthesia have received emphasis. Decrease of oxygen content and increase in carbon dioxide content of the blood are present when blood pressure is low. Cellular oxygen want depresses the sensitivity of the vasoconstrictor center. The efficiency of ephedrine is likewise decreased under such circumstances. Inhalations of pure oxygen are, therefore, indicated and prescribed when falling blood pressure occurs. Anesthetists are ever on the alert for the well defined manifestations of oxygen want.

Maintenance of Blood Pressure. Vasoconstrictors are employed in a logical manner. Prevention of excessive drop in blood pressure is attempted by their prophylactic use. A fall in blood pressure is ignored when slight, but the blood pressure is constantly observed, and if the fall becomes excessive, it is rectified by additional administrations of these drugs in small but effective doses.

Combination with Other Agents and Methods. Before the present period of spinal anesthesia, rather firm reluctance was felt toward supplementation unless absolutely necessary, because of the absence of agents applicable for such purposes and the consequent dangers involved by their use. Through the provision of cyclopropane and pentothal, especially, supplementation is now facilitated and made safe. The use of these two agents many times in minute quantities easily control certain complications such as nausea and vomiting, restlessness, tenseness and fear. Indeed, many clinicians intentionally and initially combine them with excellent results with respect to safety, efficiency and comfort, to both surgeon and patient.

Physiological Effects of Spinal Anesthesia. The large mass of experimental work completed on spinal anesthesia since 1928 has greatly enlarged our knowledge of its effects and derangements. Suffice it to say that such contributions have added largely to the safety of the method as employed today.

In conclusion, one advance in spinal anesthesia of recent origin has assumed such importance that it should not be ignored in a presentation of a historical and review nature. I am referring to the method termed "continuous," "serial" or "fractional" spinal. The method was devised by Lemmon[40,41] in order to be able to prolong the anesthetic period as long as it was necessary or expedient to do so. The method has particularly appealed to those anesthesiologists and surgeons who desired prolongation of anesthesia but were reluctant to employ drugs with greater duration of action because of their increased toxicity. With Lemmon's method, additional amounts of anesthetic drugs may be injected into the subdural space at will. To employ this technic a special needle is used which is made of a silver alloy which may be bent into sharp angles without breaking; tubing made of firm rubber with an inside diameter of 2 mm., about 30 inches in length, fitted with a Luer-lok connection to the spinal needle at one end and a stop-cock adapter to the standard Luer syringe at the other end; and a mattress which has an opening through its entire thickness which permits access to the needle *in situ* during the operation. The mattress also prevents pressure on the needle, and compression of or tension on the tubing by the body weight of the patient. The patient is placed on the mattress in the lateral position for the spinal puncture with the special needle. An appropriate quantity of the anesthetic agent in solution is placed in the syringe,

the tubing attached to the syringe, and filled with the solution to remove the air, and the stop-cock closed. One and one-half, 3, 5 and 10 per cent solutions have been employed, but the 3 and 5 per cent concentrations appear to be most popular. The tubing and syringe are finally attached to the spinal needle and the patient placed in position for the surgical procedure. The selected estimated initial dose is administered, after which additional amounts may be injected from time to time as the necessity arises.

The advantages[42] of this method of spinal anesthesia are derived from the factor of controllability and include a smaller initial dose, giving increased safety; anesthesia may be maintained over a prolonged period; failure may be prevented in the rare patient who requires a larger dosage; and an opportunity is presented for acquiring more knowledge of spinal anesthesia. The disadvantages encountered are largely technical in nature and occur with sufficient frequency to discourage its use when one is certain that a single injection is adequate. These disadvantages may be listed as: technical difficulty of introducing the malleable needle; the factor of slightly longer time required for its application; displacement of the needle may occur when the patient is moved; and there may be an increased possibility of trauma to the structures at the site of injection as compared with the conventional type of spinal anesthesia. The indications for this method will vary, but assuming one has determined to use procaine for spinal anesthesia, the general indications are: upper abdominal procedures requiring more than one hour and lower abdominal operations of greater length; exploratory laparotomies that may be either short or long in duration, depending upon the condition encountered; and patients in poor physical status—in order to avoid a large single injection.

Spinal anesthesia will no doubt assume an important rôle in the casualties of World War II. The present war differs from prior ones in that the aeroplane has been responsible for almost as large a casualty list among noncombatants as among the personnel of the armed forces in the active zones. Spinal anesthesia is impractical at Clearing Stations,[43] which are stations nearest the front where anesthesia is employed, because of the temporary nature of these hospitals. In Evacuation and Base Hospitals, spinal anesthesia is popular, unless the patients are severely shocked or in a hemorrhagic state, in which case experience in the last war made it clear how harmful the method can be in the shocked and hemorrhagic wounded.[44] Its compact nature and ease of continuity of supply account for its applicability here. If the wounded are further complicated by having been subjected to gassing, it appears that spinal and regional anesthesia should be used wherever possible as the method of choice, particularly when the patients are in the established stage, as compared to the initial stage.[45] For the treatment of naval personnel, in the sick bay itself, the risks of explosion and the lack of help narrow the choice of anesthesia to nitrous oxide, pentothal, regional and spinal anesthesia.[43] There is a possibility that the necessity of the widespread use of subarachnoid block during this appalling conflict may write another and most interesting chapter in the history of spinal anesthesia.

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THE MANAGEMENT OF THE RETAINED CERVICAL STUMP*

A BRIEF ANALYSIS OF FORTY-FOUR CASES

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THE frequency of the preformance of hysterectomy for the treatment of uterine diseases has created a problem that is presented too often to a busy gynecologist. This problem is the management of the cervical stump. Although total hysterectomy is becoming more and more widely performed at the present time, Kennedy[2] estimates that 95 per cent of all the hysterectomies performed in the country are subtotal. Larger clinics[4,6,7] have inclined toward the total operation, but the general surgeon and the occasional operator have not followed this trend. Perhaps the chief reason for this is that the total operation is technically more difficult in untrained hands. Another possible cause is the fact that diseases of the cervix are often discounted or overlooked when hysterectomy is contemplated.

That a diseased cervical stump can and does give rise to distressing symptoms has received but little attention in medical literature. In a series of 6,550 subtotal hysterectomies performed at the Johns Hopkins Hospital during a forty-two-year period, Henriksen[5] reported that 131 women (2 per cent) returned complaining of symptoms referable to benign disease of the stump. This is, of course, an uncorrected figure and probably does not represent the true incidence because no attempt was made to follow the patients postoperatively. During 1939 at the Mayo Clinic, excision of the cervical stump was performed on twenty-eight patients.[3] From 1931 to 1941, we have operated upon forty-four women for abnormal conditions of the cervical stump. During this same ten-year period we performed 293 subtotal hysterectomies. These statistics suggest that this condition is not uncommon and it is probable that often enough the complaints of these patients have not been recognized as originating in the cervical stump.

SYMPTOMATOLOGY

Although relief from complaints arising in the uterus results *pari passu* from subtotal hysterectomy, those complaints from pre-existing cervicitis remain unchanged. Perhaps many surgeons fail to correlate vague pelvic complaints with cervicitis, and perform an elective subtotal hysterectomy. Removal of the body of the uterus does not improve the condition of the cervix, but, on the contrary, tends to induce continuation and extension of the infectious process.

Chronic cervicitis of the cervical stump presents the same clinical manifestations as this condition does before the uterus has been removed. The most constant symptoms are a persistent leukorrheal discharge, backache, pelvic pain and urinary discomfort. (Table 1.) All forty-four patients in

TABLE 1
SYMPTOMS

	No. of Cases
Leukorrheal discharge	44
Bloody discharge	14
Pelvic pain	20
Dyspareunia	9
Backache	21
Dysuria	20

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our series were troubled with an abnormal vaginal discharge of varying amounts. Many women have been led to believe that a vaginal discharge is not abnormal unless it contains blood. This is especially true in women in whom the menstrual function has been destroyed by hysterectomy. Whereas most of these patients presented mucous and watery discharges, fourteen reported spotting or frank vaginal bleeding. Needless to say, the latter were considerably alarmed.

Combinations of pelvic pain, backache and dyspareunia are frequent, resulting from lymphatic extension of the infectious process into ligaments supporting the cervix. Such pain can readily be reproduced on manipulation of the cervix during bimanual examinations. Dysuria and even marked prolapse of the stump are also encountered.

In certain cases the cervix, though sometimes least suspected, may be a focus of infection. In two of our cases all evidence of general infection disappeared following removal of the stump. One of these women gave a history of subtotal hysterectomy for fibroids eight years before. She came in complaining of severe abdominal pain. She had been treated unsuccessfully by several physicians, none of whom suspected the cervical stump. Physical examination revealed closure of the external os, hypertrophy of the cervix and retention of infected cervical secretions. The abdominal pain completely disappeared following removal of the cervical stump, and the patient's general health greatly improved. The other patient gave a similar history with a persistent low grade fever which was likewise eliminated by removing the stump. The improvement in the general well being of these patients after operation was remarkable.

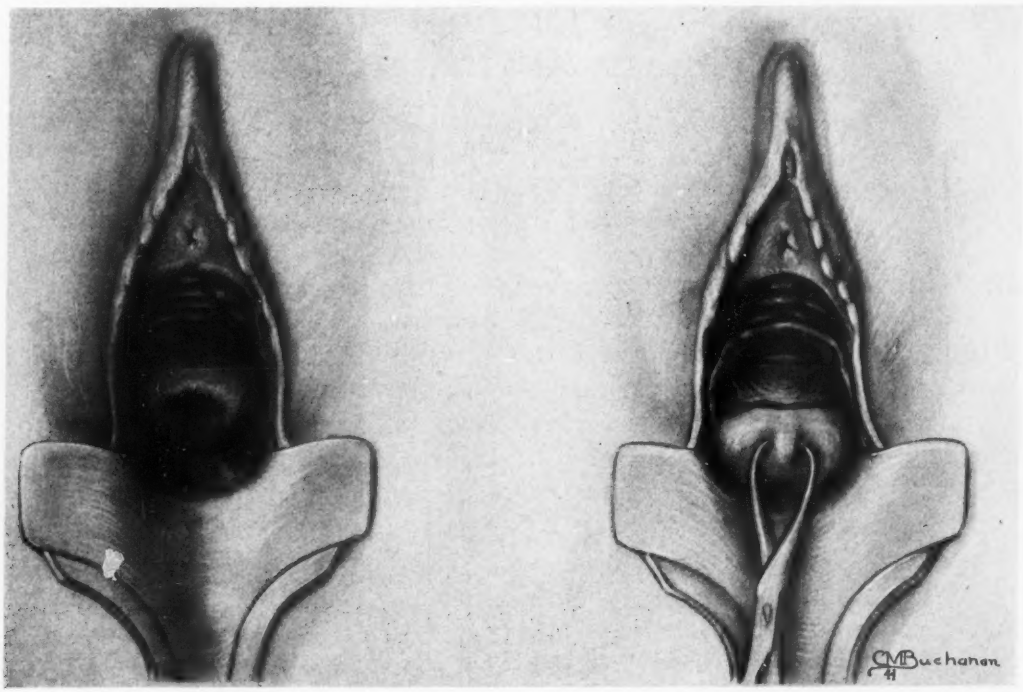

FIG. 1. FIG. 2.

FIG. 1. Preoperatively the cervix was hypertrophied and chronically diseased with stenosis of the external os. The smallest sound could not be passed. This cervix was apparently normal at the time of subtotal hysterectomy eight years previously.

FIG. 2. A circular incision is made around the cervix and the mucous membrane is elevated, exposing Mackenrodt's ligaments. Dissection is continued upward separating first the bladder then the peritoneum from the anterior and superior aspects of the stump.

MANAGEMENT

The general management of chronic cervicitis of the cervical stump does not

differ from the treatment of the infected cervix when the uterus has not been removed. General conservative therapy should be tried before radical procedures are contemplated. Conservative measures include dilatation and office cauterization. Such cauterization should be done only when erosion or eversion exists without extensive cervical hypertrophy and cystic changes. Some gynecologists have advocated deep cauterization[1] at the time of hysterectomy. This might impede the development of malignancy, but symptoms of chronic cervical infection will persist in many cases. Extensive cauterization is also undesirable because it predisposes to the formation of stenosis of the cervix, which interferes with drainage and causes retention of cervical secretions. Stenosis may follow cauterization of the stump following hysterectomy. In one of the cases reported this led to abscess formation. When nonoperative means prove unsuccessful, or in the presence of hypertrophy, stenosis or bleeding, surgical removal of the cervix is indicated. A Shroeder or Sturmdorf amputation or conization is not sufficient; the entire cervical stump should be extirpated. Removal of the cervical stump is a technically easy operation to perform. When the stump is removed, plastic procedures such as repair of cystoceles or rectoceles can and should be done.

Table II

Type of Operation	No. of Cases
Removal of stump	39
Fothergill operation (normal stump)	2
Radium application to stump (biopsy showed cancer)	1
Vaginectomy with removal of stump	2
Associated Procedures	
Hemorrhoidectomy	2
Anterior colporrhaphy	10
Posterior colporrhaphy	10
Cauterization of Skene's glands	1

TECHNIC

An elliptical incision is made around the cervix. The mucous membrane is then dissected free from Mackenrodt's ligaments laterally, from the pubocervical fascia anteriorly and from the peritoneum and ligamentous attachments superiorly. The peritoneum can usually be elevated without opening it. This obviates the danger of

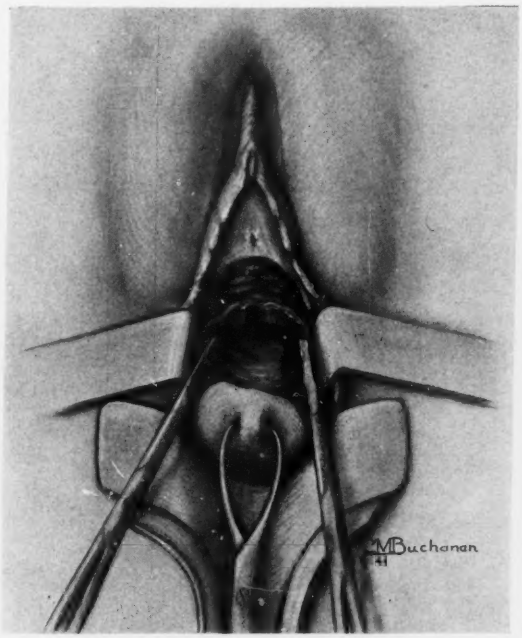

Fig. 3. Ochsner clamps are applied to Mackenrodt's ligaments, which are severed and ligated with transfixion ligatures. This frees the cervix almost completely.

injury to the intestines should they be adherent to the cervical stump. If necessary, the cul-de-sac can be opened from behind and the dissection continued anteriorly to prevent such injury. If this is done, suturing the uterosacral ligaments together will aid in supporting the vaginal vault and will prevent the formation of an enterocele. The wound is closed by suturing Mackenrodt's ligaments together and repairing the defect in the mucous membrane.

In the presence of prolapse of the cervical stump accompanied by cystocele and rectocele, the prolapse can be corrected by parametrial fixation together with the usual repair of the associated conditions. However, this should be done only if there is no other abnormal cervical condition than the prolapse.

COMMENT

An intensive analysis of the forty-four cases in this series cannot be made because it is believed that the series is too small to

form any generalities. However, a few statistics are of sufficient significance to prove informative. The average interval between hysterectomy and removal of the cervical stump was 7.1 years. The exact significance of this figure is not known. This figure would suggest that the assumption that removal of the uterus will lead to atrophic changes in the cervix within a few years is erroneous. It would appear that in these cases disease of the cervix has been progressing during this interval to an extent requiring surgical excision. In many of these cases the patients have complained of symptoms for many years. The average parity was 2.9. The average interval between the birth of the last child and removal of the cervix was 12.5 years. It is interesting to note that three of the women in the series were not married. This suggests that possibly these unmarried women had had no vaginal examination prior to laparotomy, or that the assumption that chronic cervicitis does not exist in unmarried women is unwarranted. The average age in our series was 44.2 years. It can readily be seen that these patients fall in the age group in which carcinoma is most likely to occur. In one case carcinoma was diagnosed by biopsy and radium was inserted into the cervical canal. In two of the remaining cases early malignant changes were found on microscopic examination. Removal of the cervix at this early stage was a valuable prophylactic measure for these two patients.

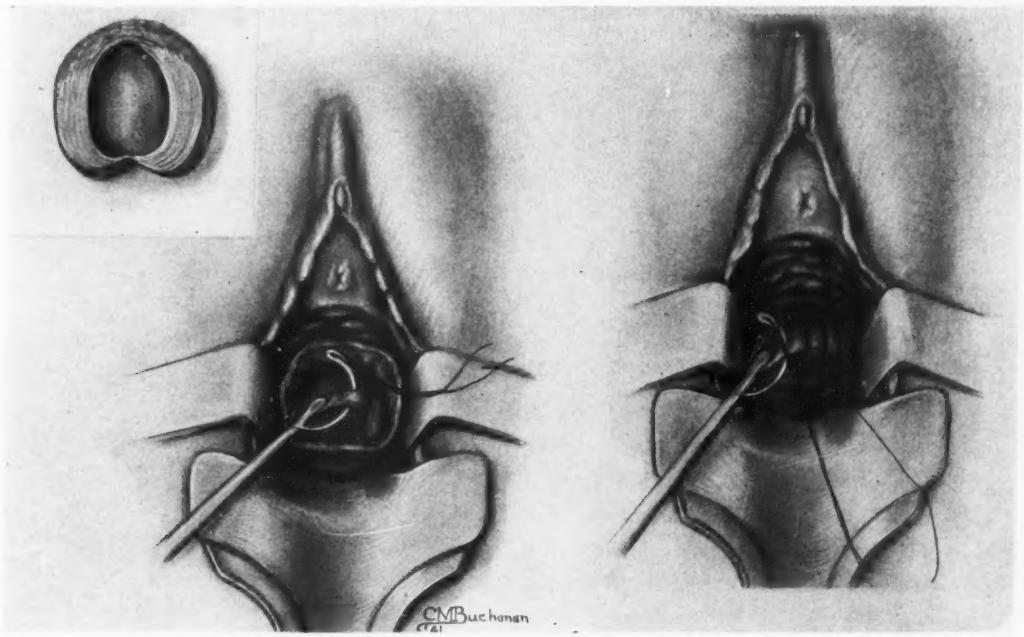

FIG. 4. FIG. 5.

FIG. 4. The remaining ligamentous attachments of the stump are severed, and reconstruction of the vaginal vault is begun. Mackenrodt's ligaments are sutured together, to the pubocervical fascia and to the uterosacral ligaments. Reconstruction of these ligaments are necessary to prevent future prolapse of the vaginal vault. *Inset:* The extirpated cervical stump has been bisected, showing a dilated endocervical canal. This cavity was filled with mucopurulent secretion.

FIG. 5. To complete the operation, the defect in the mucous membrane is closed with a continuous suture. Drainage is not necessary.

In one case subtotal hysterectomy was performed for uterine fibroids within two years of intra-uterine radium therapy. The cervix, removed a year and a half later, revealed active endometrial transplants.

A proper examination of the vagina and cervix should be conducted when a hysterectomy is contemplated and the decision as to total or subtotal operation should be made accordingly. If the surgeon believes that a total operation, although indicated, is too formidable to be done in certain

cases, the subtotal operation should be performed. The patient should then be reminded that the cervix has not been removed and that she should return for the removal of the diseased stump within a year. The increase in total hysterectomies over subtotal hysterectomies in the large clinics indicates that the undesirable effects of a retained cervical stump are becoming generally recognized.

There is no additional danger in removing the cervical stump than in doing any plastic operation on the vagina. There were no deaths in our series and the hospital course was short and uncomplicated in all cases.

SUMMARY

1. The importance of recognizing pathologic conditions of the cervical stump is emphasized.

2. The performance of complete hysterectomy in all indicated cases is urged.

3. The treatment of chronic diseases of the cervical stump is discussed and the technic of removal of the stump is described.

4. Forty-four cases of chronic cervicitis of the stump are briefly analyzed.

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THE INFLUENCE OF ESTROGENS ON GENUINE PRE-ECLAMPSIA AND ECLAMPSIA

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THAT estrogens are helpful in the prophylaxis of true convulsive eclampsia has been claimed by both Siegler[1] and the author.[2,3] The basis for such treatment, of course, is the finding that in eclampsia the estrogen values in both blood and urine are low,[4,5] and the interesting experiments of Margaret Barrie[3] who produced eclampsia-like conditions in rats. The Smiths[6] have recently stated their belief that the low estogen level is the fundamental endocrine imbalance in eclampsia. It is probably unfortunate for the future of the hormone management of eclamptic toxemia that certain workers have, on this basis, begun to administer simultaneously prodigious doses of estrogens and progesterone, which are antagonistic substances.

To the previously published histories, the following case reports of eclamptics may be added. They substantiate what has been claimed for oestrogen therapy in this disaster of pregnancy:

CASE REPORTS

CASE I. (Courtesy Dr. W. Hughes.) This primipara, aged sixteen years, was first seen at 10 P.M. December 7, 1941. She had seemed normal until December 6, when she had had a one plus albuminuria. Her pressure then was 135/70. She was at term and had gone into labor spontaneously at 3.00 A.M. on December 6 at a hospital twenty-five miles from here. The pains subsided, only to return at 2.30 A.M. on December 7. She mentioned some headache and dizziness during the three hours prior to delivery and a mild stupor soon developed. She was given ½ cc. of pituitrin fifteen minutes before delivery. She had nembutal but no anesthetic for the labor, indicating the depth of her stupor. She finally delivered spontaneously at 8 A.M. on that day. The placenta showed no infarction. The child was a 7 pound 3 ounce normal child.

Her first convulsion came on at 12.30 noon and there were eight altogether before I saw her at 10.00 P.M. At that time there was no edema. She was restless, disoriented, but admitted no headaches nor eye symptoms. She had been given ⅙ gr. of morphine sulfate for her last convulsion at 8.00 P.M. There was no liver tenderness. There was acetone on the breath. Her blood pressure was 135/65.

A retention catheter was inserted at once, and 100,000 International Units of progynon B was injected intramuscularly at the same time. Doses of 50,000 units were ordered for 3.00 A.M., 8 A.M. and 12.00 noon next day. On account of the acidosis she was given 500 cc. of 10 per cent glucose intravenously at once. The catheter urine showed a two plus albuminuria but no red cells or bile. The blood estrogen[7] was weakly negative. I did not see her after that evening. At 1.20 A.M. she was given gr. ¼ morphia as there had been a convulsion at 1.00 A.M. She had an eight-minute long convulsion at 2.25 A.M. During that night her output was 28 ounces, almost free of albumen. At noon her pressure was 136/70. The intravenous glucose had been repeated at 10.00 A.M. by her own physician.

On the morning of December 9 there were three more brief convulsions, involving only the arms or face. She had had no estrogens since noon of December 8. Accordingly, she was given 5 mg. of stilbestrol three times on the ninth and twice on the tenth day. She was quite clear mentally during all that day and there were no more convulsions.

On December 10 a puerperal psychosis began. This cleared up by December 17 and she was discharged from hospital on December 20. She has since displayed some schizophrenic tendencies.

CASE II. This woman had previously had a term stillbirth, due to a hard forceps, and a spontaneous abortion. Her third pregnancy began on November 11, 1940, when she was

thirty-seven years old. When she was seen first on January 7, 1941, her weight was 163 pounds, her blood pressure 148/94 and her blood estrogen was positive. She began to vomit a great deal. This was controlled quite well by repeated hypodermic injections of testosterone propionate.[8] On March 10 her weight was 168 pounds, blood pressure 136/90, and there was no edema. On March 25 her pressure was 146/94 and the dose of wheat germ oil (Kelly's) she had been taking was accordingly raised to three tablespoons per day. On May 6 her weight was 177, her pressure had jumped to 170/96 and there was a moderate degree of edema of the legs.

I was called to see her in convulsions at 7.30 A.M. on May 21. Her sister had noticed a smoky urine for two days before and there had been great edema of the face, legs, and hands for four days before. I gave her gr. ½ of morphia and sent her to the hospital. Her tongue was greatly swollen and she was stuporous. A retention catheter was inserted, and two ounces of smoky urine were obtained, containing 40 Gm. of albumin per liter. She was given 50,000 International Units of progynon B although her blood estrogen was still positive. The progynon B was repeated every four hours, so that she had four doses by nightfall. By 9.30 A.M. of May 21, she was rational, had no headache, but had blurred vision. At 11.00 A.M. she was sleeping quietly with no improvement in output. By 12.30 noon the output had begun to increase, she could read, and her tongue was only half as swollen as at first. She could remember everything up until 7.10 A.M. of that day.

At 8.00 P.M. the volume of urine output was steadily increasing and the urine was much less bloody, but the albumin was still 4 plus and 24 Gm. per liter, and her blood pressure was slowly rising. She seemed well and rational and had less edema of the eyelids. By 10.30 P.M. she was becoming restless and confused and her pressure had not dropped. A bag induction with rupture of the membranes was carried out under cyclopropane anesthesia. The child was alive at that time. Her pressure soon fell to 160/100 thereafter and she dozed quietly most of the night.

On the morning of May 22 she had no pains, and there was a fair amount of bloody urine output. There was much less edema generally. She felt and looked well. All day her pressure varied between 190/124 and 180/110. Strong uterine contractions began at 3.00 P.M. The bag came out at 9.15 P.M. By version and extraction a six months female child was delivered at 10.30 P.M. The placenta seemed normal but was slightly adherent. Her pressure was 170/116 just after delivery. Next day there was only a one plus albuminuria, 3 to 5 Gm. per liter.

She made an uninterrupted recovery. She left the hospital on May 31 with a 2 plus albuminuria (catheter) and some hypertension. On both August 15, and October 20 there was still a trace of albumin in the urine. Her blood pressure on June 13, 1941, was 156/102. She felt well then and still does.

Case III. This woman, aged thirty, had had a stillborn premature baby after eclampsia and two live children after her next two toxic pregnancies. She was admitted to the hospital in a semiconscious state on February 18, 1942, at 2.45 A.M. She was not due until April 5, had had the usual antenatal care in the country, and had had a blood pressure of 160/100 and a slight ankle edema when she had last reported three days before. There had been great edema of the eyelids, blurred vision, uterine pain and "indigestion" the day before admission. A mustard plaster had been used for this. She had also bled from the vagina on that day. She later mentioned that there had been no fetal movement since the afternoon of that day. There had been a convulsion at midnight. At that time her physician in the country had administered ⅜ gr. of morphine.

When she was seen by us she was wildly incoherent and threshing about. Her pressure was 90/70. There was a slight ankle edema. It took three people to hold her in bed and it was quite impossible to listen to the fetal heart. We stayed with her for two and one-half hours, and finally she became more manageable with an additional ¾ gr. of morphine. A retention catheter was inserted at the first, of course, and 100,000 International Units of progynon B were given intramuscularly. Her first 2 ounces of urine showed 4 plus albumin and 15 to 20 red cells and 30 to 50 white cells per low power field.

By 8.00 A.M. she was still somewhat frantic, and unfortunately got another ¼ gr. of morphine from the house officers. Her urine then showed only a 2 plus albumin. Her output had increased greatly but could not be measured as she had spilled into the bed after tearing out her catheter. At 9.00 A.M. she seemed nearly rational. By 10.00 A.M. she could count fingers and

henceforth was well oriented. Her blood pressure then was 106/90. She was given 5 mg. of stilbestrol every three hours that day, and daily thereafter, with no further sedatives. Opthalmoscopic examination of the fundi showed no abnormality. There was a slight edema of the abdominal wall. At 10.30 A.M. weak pains began but soon stopped. She slept much of the day. Her urine at noon had only a 2 plus albumin.

At 2.00 P.M. her pressure was 108/86 and 12 more ounces of urine had been obtained. There was much pus but almost no red cells. The fetal heart beat could not be heard. By 7.00 P.M. her output had been 8 ounces, her pressure was 120/86, and the membranes were ruptured artificially. Her speech was slightly thick and her tongue numb. There was old blood in the amniotic fluid. Weak pains soon began. At 11.00 P.M. her output was another 18 ounces and by 4.00 A.M. on February 19 another 38 ounces had been passed, with a 3 plus albumin, much pus, and some red cells.

She precipitated, at 5.35 A.M. of the same day, a stillborn female child, not macerated. The placenta was normal in appearance. At 10.00 A.M. her pressure was 135/90 and she seemed normal in every way. On the following day her blood pressure was 160/108 and on February 23 134/76. Her recovery was uninterrupted.

An intravenous estrogen of high potency is a real desideratum for these cases. This has been pointed out before[9] and certainly merits the consideration of the pharmaceutical houses. Estradiol benzoate given intramuscularly takes about seven hours to act, and much can happen to a convulsive patient in that time.

TRUE PRE-ECLAMPSIA

Case IV. This patient, a primipara aged twenty-seven years, was first seen on May 22, 1940. Her last menses had begun on February 23. Her weight was 135, her blood pressure 106/76 and her urine was free of albumin. Her blood estrogen was positive and, therefore, she was put on a dram of Kelly's wheat germ oi daily. This was raised to a tablespoonful per day in September because of uterine tenderness and vaginal "pressure," and she went to Muskoka on a vacation. Suddenly, on September 20, she developed considerable edema extending up to the knees, a morning headache, and some vague visual symptoms. There was no liver tenderness nor elevation of blood pressure. Her weight was 138 pounds. Her urine was clear. There was nothing to suggest either a nephritis or nephrosis.

Suspecting that the wheat germ oil was precipitating an early eclampsia,[3,10] we gave no more. After three and a half days, by which time all vitamin E effects should have worn off, the estrogen test was still negative; therefore, we concluded that she might do better on an estrogen. She was given 2 mg. of stilbestrol per day. Her symptoms and edema disappeared promptly. Late in October some leg edema recurred. On November 11, her weight was 155 and pressure 110/66, on 4 mg. of stilbestrol per day at that time.

On December 3, her blood pressure had risen to 140/100, there was a trace of albumin in the urine, her weight was 154, there was a slight leg edema, and she had begun to have morning headaches and spots before her eyes for the first time in months. Accordingly, her dose was raised to 5 mg. of stilbestrol per day. On December 5, there was no edema, no albuminuria, her pressure was 126/76, she felt well and she reported that she had had profuse urinations in the preceding two days. She had occasional spots before her eyes in the next nine days, but no headaches nor edema.

Labor began spontaneously on December 14. A maximally difficult breech delivery resulted in a fine 8 pound baby girl. Both mother and child did well.

On March 25, 1941, her weight was 146 and blood pressure 102/70. There was no albuminuria.

Case V. This was an unmarried primipara, eighteen years of age, whose last menstrual date was April 28, 1941. She was first seen October 27, 1941, when her weight was 130 pounds, her pressure 110/64, her urine clear, and her blood estrogen negative. She had a completely uneventful pregnancy. On January 31, 1942, her weight was 135, her pressure 144/70 and her urine clear. There was no edema. On February 6, 1942, she began labor spontaneously at 10.00 A.M. She was sent to the hospital. By 5.00 P.M. she was dilated almost 7 cm., with moderate pains occurring every three to five minutes. At 8.30 P.M. she was 9 cm. dilated, and was drowsy between pains. She was completely oriented and had no headaches nor visual complaints. There were strong pains every two minutes but

no outcry. Indeed, she probably could have delivered without anesthesia. A catheter urine sample revealed but the faintest trace of albumin, but only two ounces was obtained, the first since admission. There were jerky little hand and arm movements if her body were touched and her reflexes were markedly hyperactive. Her blood pressure had jumped to 140/96. She was a direct O.D.P. at the outlet at 9.45 P.M. and accordingly a manual and forceps rotation and low forceps delivery were done. The child was an 8 pound 13 ounce boy and his shoulders were very difficult to extract. The placenta came in thirty minutes and showed only one, old white infarct 2 cm. in diameter near one margin, penetrating the placental substance.

She was given 100,000 International Units of progynon B during delivery and 50,000 units more at 1.00 A.M. Next morning she seemed normal in every way, had a blood pressure of 116/84, but a catheter urine showed a 1 plus albuminuria. She was put on 5 mg. of stilbestrol daily and made an easy convalesence.

Case VI. This woman, aged forty years, had had two normal pregnancies, then a spontaneous abortion, and finally a macerated premature. Her last menstruation began November 12, 1939, and she was first seen February 2, 1940, when her weight was 142 pounds, urine clear, blood pressure 140/84 and blood estrogen negative. She was well until May 9 when her weight had risen to 155 and her pressure to 150/78; therefore, she was given 2 mg. of stilbestrol per day. On June 11, her weight was 156, her pressure 140/78, and she had a minimal leg edema, but a clear urine. Her stilbestrol dose was raised to 4 mg. on June 25. On July 2, her weight was 160, pressure 184/112 and her stilbestrol was reinforced with 50,000 International Units of progynon B. On July 5, her weight had fallen to 159, her pressure to 156/105 and her urine was still normal. She was put on a daily dose of 5 mg. of stilbestrol henceforth. She had 50,000 International Units of progynon B twice a week and by July 18 her weight was 162 and her pressure had dropped to 156/90. There was some leg edema at this time. On July 30, her weight was 164, her pressure was 176/104, there was considerable leg edema and the urine had a plus albumin for the first time. On August 15, her weight was 162, pressure 178/90 and there was a 2 plus albuminuria. She went into labor spontaneously on August 18, but was slow in getting under way; her membranes were artificially ruptured at 10.30 A.M. the following day. Strong pains began at 8.00 P.M. At noon on August 20 a 7 pound 10 ounce girl was delivered. The placenta came easily, displaying a white infarction of a cotyledon at one margin. She had some postpartum bleeding and severe shock, but thereafter made an easy convalescence.

On October 24, her pressure was 160/96. The following March she had an operation for glaucoma.

Case VII. This primipara, aged twenty-eight years, menstruated last on July 20, 1940. When she was first seen on September 12 she had a blood pressure of 156/108, a clear urine, and weighed 132 pounds. Her blood estrogen was weakly negative. On October 21 her weight was 134, her pressure 138/90 and she was therefore given 2 mg. of stilbestrol per day. This dose was reduced to 1 mg. on October 28 when her blood pressure had fallen to 106/68, but was raised to 2 mg. again on January 27, when her weight was 155, pressure 114/76 and a minimal amount of leg edema had appeared. On March 13, the edema of the legs was very marked, her weight was 160, and her pressure 144/76. She was then taking 5 mg. per day of stilbestrol. On March 20, her weight was 163 and pressure 104/68. She went into labor spontaneously on March 27 with only moderate pains and was completely dilated in four hours. A boy weighing 6 pounds 9 ounces was soon delivered. The placenta came easily. There was one small, shallow, marginal crescent. There was some bleeding after I had left the hospital and therefore 1,000 cc. of intravenous glucose was given She made a good recovery. On May 26, 1941, her blood pressure was 140/86 and her weight 142 pounds.

Case VIII. This woman had had one normal pregnancy. She was twenty-nine years old when seen on January 23, 1941, in her second pregnancy. Her last menstruation had begun on September 8. When seen she weighed 136 pounds, had a pressure of 126/80 and a negative blood estrogen, with clear urine. On February 20, her weight was 140, her pressure 150/88, her urine still was clear and there was no edema. She was put on 2 mg. of stilbestrol per day. On March 10, her weight was 145 and pressure 134/76, with no edema. On April 15, her weight was 150 and pressure 120/90, with slight leg edema. She was raised to 3 mg. of stilbestrol per

day. On May 22, her weight was 157, pressure 144/86, there was no edema and the urine was clear. She was raised to 5 mg. of stilbestrol per day. On June 12, her weight was 159, pressure 140/96, there was no edema, she felt well and the urine was clear. She was taken off salt and milk. On June 21, she precipitated, at home, an 8 pound 4 ounce normal female. The placenta was normal. Her convalescence was uneventful.

Case IX. This patient was a primipara, aged twenty-one years. Her last menses began on March 2, 1940. When seen first on October 17 her weight was 166 pounds and her pressure 142/88; there was no edema, but a slight hydramnios, and the blood estrogen was a weak negative. Accordingly, she was put on 2 mg. of stilbestrol per day. This nauseated her. Accordingly, she was changed to 0.24 mg. theelol per day. On November 14, her weight was 172, pressure 134/82, and there was a trace of albuminuria. The hydramnios had gone. On November 21 she had a plus albuminuria, her pressure was 120/80 and there was slight edema of the ankles developing. Labor began spontaneously on December 11 at midnight. The pains were weak throughout. At 2.20 P.M. I did an extremely difficult midforceps and delivered a fine 9 pound 2 ounce boy. The placenta showed three very shallow whitish areas near the margin. There was slight postpartum hemorrhage. The next day her pressure was 144/86. She developed a mastitis after she left the hospital.

Case X. This woman had had an induced abortion previously. When first seen on July 13, 1940, she was twenty-six years old. Her last menses had begun on March 23. Her weight was 118 pounds, her pressure was 114/60, her urine was clear, and her blood estrogen was negative. On October 1, her weight was 133 pounds, and her pressure had suddenly increased to 126/86. There was a slight edema of the fingers and legs. The blood estrin was again negative, and she was therefore given 2 mg. stilbestrol per day. On October 8, her pressure had dropped to 112/66 and she felt well. On November 9, her weight was 141, pressure 110/70 and she complained of hot flushes and spots before her eyes. On November 30, her weight was 144, her pressure 118/70, there was some edema of the fingers, and she admitted that she had been off the stilbestrol for a week. There were still spots before her eyes but no headaches; she said her head "pounded" when she was taking no stilbestrol. The blood estrogen again was negative. She was again given 2 mg. of stilbestrol per day.

On December 28, her weight was 151 pounds, her pressure 112/74, and there was slight edema of the legs and fingers. She had had great edema three days before, had raised her own dose to 8 mg. per day and volunteered the observation that a great increase in urine output had ensued. On January 7, her weight was 154 pounds, her pressure 114/60, she was "sleepy," had specks before her eyes, had slight edema and complained that her head felt "full"; and so was given 50,000 International Units of progynon B. She was induced on January 9 when ten days overdue with artificial rupture of the membranes. She had a low transverse arrest and forceps delivery of a boy weighing 7 pounds, 11 ounces. The placenta had one narrow, white, marginal crescent. She had an acute mastitis of both breasts after her discharge from the hospital.

Case XI. (Courtesy of Col. W. Mace.) This patient, aged twenty-nine years, was a primipara. Her last menses began on November 15, 1940. When her physician joined the army she was sent to me. On July 10, 1941, her weight was 175 pounds, her blood pressure was 132/94, and there was a minimal edema of the legs and fingers. Her blood estrogen was negative; therefore, she was taken off salt and milk and given 2 mg. of stilboestrol per day on July 21. On July 29, her weight was 176, her pressure 134/94 and the edema was the same. There was some cholecystitis. Her urine was clear. The dose of stilbestrol was raised to 4 mg. per day. This was maintained until her delivery. On August 23, her weight was 180, her pressure 132/96, there was a trivial leg edema, and the urine was clear. Spontaneous labor began on August 24. Her pains were very sluggish and she was rested that night with morphia. In the morning her membranes were ruptured artificially. A forceps rotation was finally done and a 7 pound, 12 ounce boy was delivered. The placenta came easily. There was one tiny marginal crescent on the maternal surface. The recovery was uneventful.

Undoubtedly, in the light of later experience, many of these women should have had larger doses of estrogens.

DISCUSSION

It has been said "There are no hopeless situations; there are only men who have

grown hopeless about them." These case histories speak for themselves. A careful perusal of them will indicate the value of estrogens in the management of true pre-eclampsia and even in convulsive cases of eclampsia. It is to be noted that all the pre-eclamptics remained ambulant. This therapy should be, and is, more effective for pre-eclampsia than for eclampsia, for prophylaxis than for therapy. Therefore, the recognition of true pre-eclampsia is the crux of the situation. This is usually difficult on a purely clinical basis; a blood estrogen assay is a *sine qua non*. Those who object to the author's assay method[7] must find one that is more satisfactory and use it. Otherwise this therapeutic method will be discredited, for estrogens given to the vast majority of so-called pre-eclamptics can be of no assistance and may actually do harm, perhaps precipitating abruptio placentae.[2,11] Most so-called "pre-eclampsia" cases already possess too high an estrogen, should be given vitamin E, and run no risk whatever of terminating in convulsions. It is a pity that loose use of the term pre-eclampsia for every late toxemia of pregnancy should vitiate most of the literature on the subject.

SUMMARY

1. The case reports of three convulsive eclamptics and of eight true pre-eclamptics are presented in detail. One of the latter was induced and all remained ambulatory.

2. All were favorably influenced by the administration of estrogens.

3. This therapy is more effective in the prophylaxis than in the control of convulsive eclampsia, as could be anticipated.

4. A blood estrogen assay is a *sine qua non* in the recognition of genuine pre-eclampsia.

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ACUTE GASTRODUODENAL PERFORATION*

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FROM June 1, 1937, to June 1, 1942, there were ninety-one patients with gastroduodenal perforations treated on the Long Island College Surgical Division of Kings County Hospital, Brooklyn. Eighty-six were treated by immediate operation and the remaining five conservatively. A consideration of the latter form of treatment with individual case reports is included.

During this period the majority of these operations were performed by the resident house staff and the cases presented are a consecutive group.

Incidence. During a five-year period there were 19,104 surgical admissions on this service, an annual average of 3,821. Within this same period ninety-one patients with perforation of a duodenal or gastric ulcer were treated, an average of fifteen per year. There was one perforated ulcer for every 210 admissions (0.47 per cent).

Seasonal Variation. The incidence of perforation was lowest during the autumn. Throughout the other seasons of the year there was a uniformity in the distribution. The variations are shown in Table I.

Nationality. Nationalities were many and varied. The highest incidence of perforation was in the Irish, followed in close order by the Italian, Negro and Hebrew races, respectively.

TABLE I
SEASONAL VARIATIONS

Season	No. of Cases	Per Cent
Spring	26	28.5
Summer	25	27.5
Autumn	16	17.6
Winter	24	26.3

Sex. Of ninety-one cases, only six were females, a ratio of fifteen to one (6.7 per cent).

TABLE II
NATIONALITIES

Nationality	No. of Cases
Irish	17
Italian	15
Negro	12
Hebrew	11
Norwegian	8
German	5
Swedish	4
English	3
Austrian	2
Greek	2
Canadian	1
Chinese	1
Polish	1
Scotch	1
Undetermined	7
Total	91

Age Group. The highest incidence of perforation was in the fourth decade. The fifth and sixth decades, respectively, were next highest. There were no perforations in the first two nor above the eighth decade. The youngest patient was a negro male of twenty-one and the oldest a man of seventy years. There were five cases of recurrent perforation. In three, both perforations occurred in the same decade, namely, one in the third decade and two in the fourth. In the remaining two the first perforation occurred in the fourth and fifth decades, the repeat perforations occurring in the fifth and sixth decades, respectively. There was an interval of five years between perforations in each of the last two cases. (Table III.)

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Table III
AGE GROUP, OPERATIVE CASES

Age	No. of Cases	Deaths	Mortality, Per Cent
10–19	0	0	0.0
20–29	10	0	0.0
30–39	30	2	6.6
40–49	26	1	3.8
50–59	15	5	33.3
60–69	4	2	50.0
70–79	1	1	100.0
	86	11	12.8

Duration of Symptoms of Perforation. The duration of symptoms refers to the time interval between the immediate onset of symptoms and operation, and not to the interval between the onset of symptoms and admission to the hospital. There were seventy-six patients (86.4 per cent) operated upon within the first twelve hours of which forty-one (53.9 per cent) were within the first six hours, and thirty-five (46.1 per cent) in the second six hours. In one case symptoms extended over a period of fifty-nine hours. (Table IV.)

Table IV
DURATION OF SYMPTOMS IN OPERATIVE CASES

Duration of Symptoms—Hours	No. of Cases	Deaths	Mortality, Per Cent
0–6	35	0	0.0
6–12	39	7	18.0
12–18	9	3	33.3
18–24	1	0	0.0
24–36	1	1	100.0
36–48	0	0	0.0
48–60	1	0	0.0
	86	11	12.8

History of Previous Ulcer. There were fifteen cases in which no history of ulcer was obtainable. Three patients had vague complaints for one to two weeks prior to perforation, such as bloating and gaseous eructations. There were four others two of whom had symptoms of ulcer over a period of two weeks and two for three weeks. In five patients a history of previous ulcer varying between a minimum of three to a maximum of seven months was obtained. In the remaining cases the history extended over periods varying between a minimum of one year and a maximum of twenty-five years. Two had symptoms of ulcer extending over a period of twenty-five years.

Previous Perforation. In each of five cases (5.1 per cent) there had been a previous repair of a perforated ulcer. Three of these operations were performed in this hospital and the interval of time between perforations was six, seven and twenty-nine months. In the remaining two the interval of time was five years in each case.

Predominant Symptoms. Pain, tenderness and muscle spasm were predominant symptoms. These occurred in every one of the cases with the exception of one in which there was pain and associated tenderness without accompanying muscle spasm. In the majority (86 per cent) the symptoms at onset were referable to the epigastrium or upper quadrants of the abdomen. In ten (11.6 per cent) the complaint on admission was pain in the right lower quadrant and in six of these the provisional diagnosis was acute appendicitis. Despite the findings of exquisite point tenderness and muscle spasm in the right lower quadrant, there was associated tenderness and spasm in the epigastrium or upper quadrants of the abdomen. This is of importance in differential diagnosis because in early cases of acute appendicitis with localization of symptoms in the right lower quadrant it is rare to have findings referable to the epigastrium or upper abdominal quadrants. In two cases the onset of symptoms was heralded by pain in the left lower quadrant, examination revealing exquisite tenderness and spasm in this region. The latter signs were also noted to a lesser degree in the left upper quadrant. Operation in each instance disclosed a perforation in the proximal portion of the body of the stomach with a free spill in the left lumbar gutter. These were the only cases in which perforation occurred in this region of the stomach

and on admission each presented identical symptoms and signs.

Shoulder pain was recorded in sixteen cases (18.6 per cent). Obliteration of liver dullness was noted thirty-seven times (43 per cent). Vomiting occurred in forty-one instances (47.6 per cent), was absent in twenty (23.2 per cent) and not recorded in twenty-five.

Shock is often spoken of as frequently accompanying gastroduodenal perforation. In this series, however, there were only four instances (4.4 per cent) in which the patient was in shock at the time of admission. There were no cases in which delayed shock supervened following hospitalization. In Table v the predominant symptoms are tabulated.

TABLE V
PREDOMINANT SYMPTOMS

	Present	Absent	No Record	Per Cent Present
I. Pain				
Abdominal	91	0	0	100.0
Shoulder radiation	22	6	63	24.2
II. Abdominal tenderness	91	0	0	100.0
III. Abdominal rigidity	90	1	0	98.9
IV. Liver dullness	24	43	24	26.4
V. Nausea	34	4	53	37.4
VI. Vomiting	44	22	25	48.5
VII. Shock	4	87	0	4.4

Location of Perforation. There were eighty-six instances in which perforation was recognized either at the time of operation or necropsy. Fifty-seven perforations were gastric, two of which involved the proximal portion of the body of the stomach. In twenty-four the perforation was duodenal, three involving the posterior wall. The smaller number of duodenal perforations is unusual, presenting a 2.4 to 1 ratio of gastric to duodenal. This is at variance with most series that have been reported. In three instances the location of the perforation was undetermined. In one it was stated that the perforation was an equal distance on either side of the pyloric vein, and in another it involved the posterolateral wall of the jejunum immediately distal to the suspensory ligament (Treitz) of the duodenum. Three of the five patients with recurrent perforations had both operations performed on this service. In each instance the perforation was gastric.

TABLE VI
LOCATION OF PERFORATION

Location of Perforation	No. of Cases	Per Cent
Stomach	57	62.6
Duodenum	24	26.4
Jejunum	1	1.1
Multiple	0	0.0
Combined	1	1.1
Undetermined	3	3.3
Total	86	

Size of Perforation. The uniformly small size of the perforations was characteristic as witnessed by the fact that in sixty cases (69.7 per cent) the diameter varied between 0 and 0.5 cm. In ten a variation between 0.5 and 1 cm. was present. The largest perforation was 3 cm. in diameter, a report of which may prove of interest:

This perforation occurred in a sixty-eight year old white male admitted to the hospital with an eight-hour history of symptoms referable to a gastric or duodenal ulcer. The perforation, associated with adjacent inflammatory edema and marked induration of the surrounding tissues, was located on the anterior wall of the pyloric portion of the stomach. Closure either by means of a purse string or through-and-through suture was impossible. A free graft of omentum was placed over the perforation, and the edges of the graft were sutured to the surrounding anterior wall of the stomach with five interrupted sutures of fine silk. A biopsy taken prior to repair of the perforation was reported as chronic inflammatory tissue.

The immediate postoperative course was uneventful, but he returned three months later complaining of persistent abdominal pain,

hematemesis, anorexia and an interval weight loss of twenty pounds. Gastric analysis revealed a high free acidity of 145 and a high total acidity of 165. On repeated gastric lavage there was no retention or evident bleeding. A gastrointestinal series revealed the presence of a duodenal ulcer. Upon review of the case a gastric resection was considered advisable. At the time of operation there was no evident ulceration and the only landmarks of the site of previous perforation were the five imbedded interrupted black silk sutures. There was a complete restoration of the whole thickness of the wall of the stomach without cicatrization. The rapidity of healing was remarkable. His postoperative course was uneventful. Since operation he has remained asymptomatic with marked improvement of appetite and a weight gain of thirty pounds. Table VII indicates the varying sizes in the perforations recorded.

In only five instances was the systolic blood pressure below 100.

In Table VIII the cases are listed according to the temperature, pulse and blood pressure at the time of admission.

Leukocyte Count. In seventy-three (84.8 per cent) of the eighty-six operative cases a leucocytosis was present. In eleven cases, the leucocyte count was within normal range, and in two there was a leukopenia. An increase in the polymorphonuclear leukocytes occurred on seventy-four occasions, was normal in eleven and below normal in one. Table IX gives a group classification of the degree of leukocytosis.

X-ray. Roentgenograms were taken for evidence of free air beneath the diaphragm in forty-one cases and were positive thirty-five times (85.3 per cent). Six cases were

TABLE VII

SIZE OF PERFORATION

Size of perforation	0–0.5 cm.	0.5–1 cm.	1–1.5 cm.	1.5–2 cm.	2–2.5 cm.	2.5–3 cm.	3–3.5 cm.
No. of cases	60	10	1	1	0	0	1
No measurements recorded	13						

Temperature, Pulse and Blood Pressure. There were fourteen instances in which the temperature was recorded as below normal, the lowest 96°F. In thirty-four cases the temperature varied between 99° and 100°F. In only eleven cases was the temperature over 101°F. In twenty-four of the patients the pulse varied between 70 and 100, exceeding 100 thirty-four times. In the majority of the cases, fifty-one (56.1 per cent), the systolic blood pressure varied between 110 mm. and 140 mm. of mercury. negative, although at operation perforation was proved to be present.

Treatment. A total of ninety-one patients with gastric and duodenal perforation were treated on the service over a period of five years. In eighty-six cases the treatment was operative and in five conservative management was employed. In the operative group the preferred method of closure was by means of a purse-string suture of fine chromic catgut, re-enforced by an omental graft held in

TABLE VIII

VARIATIONS IN TEMPERATURE, PULSE AND BLOOD PRESSURE

Temperature	96–97°F.	97–98°F.	98–98.6°F.	98.6–99°F.	99–100°F.	100–101°F.	101–102°F.	102°+F.	
No. of cases	1	4	7	8	34	25	11	1	
Pulse	60–70	70–80	80–90	90–100	100–110	110–120	120+		
No. of cases	2	7	23	24	20	10	5		
Systolic blood pressure	70–80	80–90	90–100	100–110	110–120	120–130	130–140	140–150	150+
No. of cases	1	1	4	3	15	17	19	9	10

Blood pressure—not recorded—twelve cases

situ by interrupted sutures of fine silk. On occasion, silk interrupted sutures were used to close the perforation and an omental re-enforcement as above.

TABLE IX

VARIATION IN LEUCOCYTE COUNT

White blood count	0–5,000	5–10,000	10–15,000	15–20,000	20–25,000	25,000+
No. of cases	2	11	26	28	17	2
Polymorphonuclear leucocytes	0–25%	25–50%	50–75%	75–100%		
No. of cases	0	1	11	74		

Silk technic was used in the repair of the abdominal wound. Closure in layers without drainage was performed routinely with the exception of the occasional instance when the wound was closed with through-and-through sutures of heavy black silk.

Prior to operation a Levin tube is passed through either nostril into the stomach and fastened securely to the side of the face. The blood of the patient is typed and cross matched. Blood is always ready in our blood bank for immediate use. In the left antecubital vein an infusion of 5 per cent glucose in normal saline is started, and the patient is transferred to the operating room.

Upon return to the ward immediate gastric suction siphonage according to the method of Wangensteen is employed. Postoperatively, the suction is continuous for the first six hours. Feedings by mouth then follow according to the schedule in Table x.

The suction is alternately on and off every two hours during the next eighteen to twenty-four hours. The feedings are given at the start of the periods in which the suction is temporarily off. Subsequently, the time intervals are gradually varied so that by the evening of the second day or morning of the third day suction may be entirely discontinued and the stomach tube removed.

During the postoperative period the water and electrolyte balance is maintained by the daily parenteral administration of fluids, 5 per cent glucose in normal saline, alternating with 5 per cent glucose in distilled water. This is continued until the fourth day, at which time a sufficient amount of fluid is taken by mouth to *maintain an adequate water and chemical equilibrium.*

Following operation for gastroduodenal perforation postoperative gastric dilatation is not an infrequent complication. It is easily recognized if kept in mind. It occurs on the average of forty-eight to sixty hours following the removal of the Levin tube and the characteristic symptoms which we have noted are nausea, anorexia, rapid pulse, restlessness, apprehension and free perspiration. The response to decompression of the stomach with a gastric tube is rapid. During the past year it has been the routine practice to perform nightly gastric lavage in all cases following the removal of the stomach tube. Lavage is repeated each night until a negative or minimal gastric residue is noted. This usually occurs between the fifth and seventh days postoperatively with some variations. By this method of postoperative treatment gastric dilatation as a serious complication has been eliminated.

CONSERVATIVE MANAGEMENT OF GASTRODUODENAL PERFORATION*

During the last year and one-half we have used elective conservative therapy in five cases, with satisfactory results. It merits further discussion. The questions naturally arise: What cases are to be treated in

* Since the preparation of this paper another case has been treated conservatively. The onset of symptoms was acute and typical. Physical findings presented a textbook picture of perforation. A complicating residual pelvic abscess was drained per rectum seven days after onset. Lesion of the duodenum was confirmed by roentgenogram.

TABLE X
ULCER DIET*
Feedings Instituted Six Hours Postoperatively

Day of operation:	
Oz. 1 water alternating oz. 1 gelatin	q2h
1st postoperative day:	
Oz. 2 water alternating with oz. 2 gelatin	q2h
2nd postoperative day:	
Oz. 2 water, " milk and cream, " gelatin	alternating q2h
3rd postoperative day:	
Oz. 4 water, " milk and cream, " gelatin	alternating q2h
4th postoperative day:	
Oz. 5 water, " milk and cream, " gelatin, " gruel	alternating q2h
5th postoperative day:	
Oz. 6 water, " gelatin, " milk and cream, " gruel, " cream soup	q2h
6th postoperative day:	
Oz. 7 gruel, gelatin, cream, cream soup, custard, poached egg	alternating q2h-sips of water between feedings
7th postoperative day:	
Oz. 8 milk and cream, cereal, egg, cream soup, puree vegetable, custard, poached egg, mashed potato	q2h
8th postoperative day:	
Soft modified ulcer diet	
9th postoperative day:	
Modified ulcer diet	
10th postoperative day:	
Full ulcer diet	

*The same dietary regime is used following subtotal gastric resection and has proven eminently satisfactory.

this manner? What are the indications for and against this mode of therapy? Unfortunately, the answers to these questions cannot be given in any didactic or clear-cut form so as to govern all cases. On the contrary, each case must be rigidly individualized. In general, it may be stated that the following points are taken into consideration before we judge a case suitable to conservative treatment: (1) Duration of symptoms; (2) general condition of the patient; (3) subjective symptoms and (4) objective findings on abdominal examination.

If the duration of symptoms is in excess of twelve hours and associated with subjective improvement (the patient will often state he feels better, that the pain is not as severe, etc.), nonoperative management is contemplated. Furthermore, if he appears to be resting comfortably and the findings on abdominal examination are not marked, conservative therapy is employed. This is in contrast to the individual who is admitted complaining of severe abdominal pain, progressive in character and associated with exquisite and diffuse abdominal tenderness and rigidity. In the latter instance immediate operation is mandatory. This type of patient often assumes a sitting posture to obtain relief and appears acutely ill. On the other hand, in the cases which were treated conservatively, the patient was resting comfortably in the supine position and did not appear so acutely ill.

That spontaneous closure of a perforation may occur is unquestionable. It has been the lot of almost every surgeon at operation to encounter instances of gastroduodenal perforation in which the protective barriers of nature had sealed the area of perforation. It was this finding which we have noted in Case 1. This led us to the belief that certain cases might well be selected for conservative management. It cannot be too strongly emphasized, that if such a condition presents itself at operation, the abdomen should be immediately closed and no attempt made to break down these protective barriers in order to disclose the site of perforation. At the expense of the well-being of the patient we have seen this performed with the resulting conversion of a localized inflammatory process into a diffusing peritonitis.

During the past year twenty cases were admitted with a perforation of a gastric or duodenal ulcer. In four (20 per cent) elective conservative management was

employed with favorable results. There were no deaths and follow-up study shows them to be well. The number of patients we have treated conservatively is small, the follow-up period is short. No final conclusion should be drawn. We simply desire to state we have treated five patients conservatively and each one recovered.

We remain of the opinion that all perforated ulcers are not of necessity to be treated by operation, but that selected cases may be treated conservatively with satisfactory results. Operative intervention, of course, remains the treatment of choice. If there is a doubt, immediate operation is performed.

Review of the cases in which the patients were treated without operation shows that on two occasions the duration of symptoms was less than twelve hours. Nevertheless, conservative management was employed. Interspersed between the cases treated conservatively there were others admitted with symptoms of the same duration or longer in which operation was performed because the clinical symptoms and signs which they presented on examination favored immediate operative intervention.

We believe that a review of the cases which were treated conservatively may be of interest:

CASE REPORTS

Case 1. In this case the treatment was both operative and conservative. The outcome aroused our interest in the possibility of selecting certain cases for nonoperative management.

H. J., a white male, age forty-three, was admitted on June 15, 1941, with a history of abdominal pain, nausea and associated vomiting of twelve hours' duration. Previous history relative to ulcer was vague. Physical examination revealed a well developed, well nourished white male lying quietly in bed, not appearing acutely or chronically ill. His temperature was 102°F., pulse 86, blood pressure 120/80. Positive findings were referable to the abdomen.

The abdomen was rounded and there were no scars. Tenderness and spasm were present in the right lower quadrant and to a lesser degree in the epigastrium. There was no evident obliteration of liver dullness, no masses, or palpable viscera. Rectal examination revealed tenderness high up on the right side. *Diagnosis:* Acute appendicitis.

The leucocyte count was 13,000, 88 per cent polymorphonuclear leucocytes. Roentgenographic examination revealed the presence of free air beneath the dome of the right side of the diaphragm.

At operation on the day of admission the peritoneal cavity was entered through an upper right rectus muscle splitting incision. Approximately 100 cc. of free cloudy straw colored peritoneal fluid was present. The stomach was found adherent to the inferior surface of the right lobe of the liver. At the point of junction of the liver edge with the anterior wall of the stomach and duodenum there was a thin, filmy exudate which sealed the opposed surfaces. Cultures were taken and the wound closed in layers without drainage.

Postoperative treatment consisted of continuous gastric siphonage for a period of forty-eight hours and parenteral administration of fluids. On the second postoperative day routine postoperative ulcer dietary régime was instituted, with supplementary parenteral fluid administration to maintain an adequate water balance. The postoperative course was uneventful and he was discharged on the fifteenth postoperative day.

Comment. The condition of the patient at the time of admission appeared satisfactory. He was resting comfortably, appeared to be in no acute distress and felt subjectively improved. However, due to the presence of tenderness and moderate spasm in the epigastrium, and the roentgenographic evidence of free air beneath the dome of the diaphragm on the right side, operation was advisable. At operation the area of perforation was so well walled off that any attempt to locate the perforation by breaking down the protective barriers already present was thought inadvisable.

Case 11. F. E., a thirty-four year old white male, was admitted on August 3, 1941, with a history of onset of epigastric pain twenty-two hours prior to admission. The pain became diffuse and rapidly increased in severity; it

was associated with nausea but no vomiting. Past history revealed symptoms referable to ulcer of ten years' duration, with increasing severity of symptoms during the two years before the present admission.

Physical examination revealed a well developed, well nourished while male appearing acutely ill. His temperature was 100.6°F., pulse 80. Positive findings at the time of examination were limited to the abdomen.

The abdomen was flat, muscular and bore no scars. There was tenderness throughout with associated rebound phenomenon and moderate muscle spasm. Liver dullness was obliterated. *Diagnosis:* Perforation of a gastric or duodenal ulcer.

The white blood cell count 13,200, 76 per cent polymorphonuclear leucocytes. A roentgenogram revealed free air beneath the dome of the diaphragm on the right side.

The treatment was conservative, consisting in sedation, parenteral administration of fluids, and continuous gastric siphonage for forty-eight hours. On the second day following admission a routine postoperative ulcer diet was instituted with supplementary parenteral administration of fluids. His course in the hospital was uneventful. Local abdominal findings present on admission had completely disappeared on the fourth day of hospitalization. Gastric analysis revealed the presence of a hyperacidity with a high free hydrochloric acid of 145 and a high total of 165. A gastrointestinal series prior to discharge showed a constant deformity in the first portion of the duodenum. *Diagnosis:* Duodenal ulcer. He was discharged August 14, 1941.

Comment. Because of the duration of symptoms prior to hospitalization and the fact that he was handling his condition satisfactorily at the time of admission, conservative therapy was considered the preferred method of treatment. Follow-up examination over a period of eight months shows that he is maintaining the prescribed diet and has remained symptom free.

Case III. J. W., a white male, age fifty-eight, was admitted October 14, 1941, with a history of being awakened at 2 A.M. on that day with severe epigastric pain with radiation to the right shoulder. Two hours following onset of symptoms he took whiskey and soda without relief and was admitted to the hospital at 6:00 A.M. on the same day.

Physical examination at this time revealed a well developed, well nourished white male lying flat in bed, with positive findings limited to the abdomen. His temperature was 98.6°F., pulse 96, blood pressure 130/80.

The abdomen was flat with exquisite upper abdominal tenderness and rigidity. Marked tenderness and spasm were present in the right lower quadrant. Liver dullness was diminished. *Diagnosis:* Perforation of a gastric or duodenal ulcer.

The white blood cell count was 18,600 with 85 per cent polymorphonuclear leucocytes. Roentgenographic examination revealed the presence of free air under the leaflet of the diaphragm on the right side.

Six hours following admission, which was twelve hours following the onset of illness mild tenderness persisted in the epigastric region without associated muscle rigidity. No evidence of shock was present and his general condition was good. On October 16, his temperature was 100°F. and the patient was resting comfortably; he had no complaints and his chest was clear. There was very slight tenderness noted in the lower quadrants of the abdomen; no spasm or rebound tenderness were present. On October 18, the abdomen was soft; there were no tenderness or spasm, and he was accepting feedings well. Improvement was progressive, and the patient was discharged on October 24 ambulatory and without complaints. The hospital stay was ten days. Subsequent gastrointestinal series revealed the presence of a duodenal ulcer.

Comment. Examination within one hour after admission showed marked improvement in his condition. Tenderness in the epigastrium and right upper quadrant with moderate muscle spasm persisted but was less severe. Definite subjective and objective improvement were present. A trial of conservative therapy was thought permissible and rapid and progressive improvement in his condition occurred. To date he remains symptom free on a prescribed ulcer diet.

Case IV. G. M., a seventy-four year old white male with no previous ulcer history, was admitted on January 28, 1941, with a history

of epigastric pain of nine hours' duration. No vomiting or nausea were present; there was no shoulder pain.

Physical examination revealed a well developed, well nourished healthy white male appearing acutely ill, but resting comfortably. His temperature was 101.6°F., pulse 80, blood pressure 130/80.

The abdomen was rounded and bore no scars; there was tenderness in the upper part of the abdomen most marked in the epigastrium with associated mild muscle spasm of an apparent voluntary type. There was no obliteration of liver dullness.

The white blood cell count was 9,900. Roentgenographic examination revealed evidence of free air under the dome of the diaphragm on the right side. *Diagnosis:* (1) Questionable perforation of gastric or duodenal ulcer; (2) perforation of a neoplasm of colon.

Conservative management was followed by progressive improvement in his condition. Roentgenographic examination on the seventh day following admission revealed absorption of the previously described free air beneath the diaphragm. Barium enema was negative. Gastrointestinal series revealed evidence of a duodenal ulcer.

Comment. The diagnosis in this case on admission was undetermined. Following the demonstration of free air beneath the diaphragm by roentgenographic examination the possibility of a perforated ulcer or a perforated neoplasm of the colon was entertained, the latter due to the fact that a history of recent change in bowel habit was obtained. Due to the apparent good condition of the patient conservative therapy was advisable. He remains symptom free, one and one-half years following his discharge from the hospital.

Case v. W. H., a negro male, age sixty-one, was admitted on March 2, 1942 with a six weeks history of sharp, intermittent abdominal pains occurring two to three times a day and lasting one to two minutes. At 1:30 A.M. on the day of admission, shortly following ingestion of two drinks of whiskey and beer he noted the sudden onset of severe epigastric pain with associated nausea and vomiting. The pain caused him to double up, radiated to the left shoulder and was accentuated upon respiration. He was admitted to the hospital five hours following the onset of symptoms.

Physical examination revealed a well developed, well nourished, obese colored male appearing acutely ill. His temperature was 100.2°F., pulse 108, blood pressure 124/80; white blood cell count 16,000, 87 per cent polymorphonuclear leucocytes.

Table xi
WOUND HEALING

	No Drainage	Drainage	Total	Per Cent
No. of cases	76	10	86	
Wound healing				
Per primam	63	2	65	75.6
Per secundum	6	4	10	11.6
Undetermined as result of death	7	4	11	12.8
Wound infection	6	4	10	11.6

His abdomen was rounded but bore no scars. There were marked tenderness and spasm in the epigastrium and both upper quadrants. Tenderness also was present in the lower quadrants of the abdomen, but no spasm was elicited. Roentgenographic study revealed free air beneath the diaphragm on the right side. *Diagnosis:* Perforation of a gastric or duodenal ulcer.

Conservative treatment was employed. Six hours following admission the patient had no complaints. No change in abdominal findings was present. Within twelve hours marked subjective and objective improvement was noted. On March 5, moderate distention of the abdomen was present without associated tenderness or spasm. The distention became progressively more severe with difficulty in respiration. On March 9, there was clinical evidence of pneumonic consolidation in the left lower lobe. The same day a copious diarrhea occurred. The abdomen was soft, flat and nontender. On March 14, his condition was greatly improved. Rectal examination at this time revealed no evidence of a pelvic abscess. The temperature varied between 100.2° and 103.6°F. for the first eight days following his admission, gradually returning to normal on March 20 where it remained until the time of discharge on April 11, 1942.

The immediate treatment consisted of continuous gastric siphonage, sedation, and the parenteral administration of fluids. On March 3, feedings by mouth were started but were discontinued on March 6 due to the marked distention of the abdomen which was present. The subsequent treatment consisted in blood transfusion, oxygen administration (tent) and sulfadiazine therapy. A satisfactory response occurred.

The gastrointestinal series on April 3 revealed the presence of a duodenal ulcer. Gastric analysis on April 8 showed normal values.

Comments. The response in this case to conservative therapy was quite satisfactory until the third day following admission. Then moderate distention occurred at which time there was complete absence of abdominal tenderness and spasm. Distention was progressive over a period of four days with a complicating lobar pneumonia. Condition responded to prescribed treatment although the convalescence was stormy. On follow-up he remains asymptomatic and is maintaining prescribed ulcer diet.

Case VI. D. R., a white male, age fifty-one, was admitted on August 29, 1941, with a history of sudden onset of severe generalized abdominal pain sixteen hours prior to admission. The pain caused him to double up, and was most marked in the epigastrium and umbilical region, and of an increasing severity. No previous history of ulcer was obtained.

Examination at the time of admission revealed a well developed, well nourished white male appearing acutely ill. His temperature was 101°F., pulse 64, blood pressure 94/50.

The abdomen was scaphoid with tenderness and boardlike rigidity in the epigastrium and upper quadrants. Tenderness without spasm was present in the left lower quadrant. *Diagnosis:* Perforation of a gastric or duodenal ulcer. Roentgenograms were not taken at the time of admission for evidence of free air beneath the diaphragm.

Routine conservative therapy was instituted followed by rapid and progressive improvement. Abdominal tenderness and rigidity had completely disappeared by the third day of hospitalization. Gastric analysis revealed a moderate hyperacidity and a gastrointestinal series demonstrated the presence of a duodenal ulcer. Hospital stay was twenty-four days.

Comments. Due to the long duration of symptoms prior to admission and with the general condition of the patient satisfactory, conservative therapy was the treatment of choice, with complete relief of symptoms and signs within three days following admission. This is the only case presented in which roentgenograms were not taken to demonstrate the presence of free air beneath the diaphragm.

Drainage. Insertion of drains into the peritoneal cavity or wound is not advocated. In the eighty-six cases in which operation was performed drainage was omitted in seventy-six of the patients, and used in the remaining ten. The cases in which drainage was not used, primary wound healing was obtained in sixty-three (82.9 per cent). In two cases there was no statement regarding the character of the wound healing. Seven of the patients who were not drained died, and thus wound healing was not determined. In the ten cases in which drainage was instituted wound healing was stated to be primary in two and secondary in four. Four of the patients who were drained died and again as above the character of the wound healing was not determined. Wound infections occurred in ten cases, a percentage of 11.6 per cent. The sulfonamide group of drugs was used locally in the peritoneal cavity and also in the wound prior to closure in only five instances and no conclusions are drawn.

Complications. There were no complications in fifty-four of the cases. In the remaining the complications were chiefly pulmonary in nature, with wound infections and peritonitis, respectively, the next in frequency. Several of the patients in this series had more than one complication. One of the patients developed in sequence a postoperative wound infection, pelvic abscess, lung abscess, bronchopleural fistula and empyema with recovery

after a hospital stay of eighty-nine days. In Table XII there will be found a list of the complications encountered following operation for perforation of gastric or duodenal ulcer.

TABLE XII
COMPLICATIONS

I. Complications		
A. Pulmonary		
Bronchopneumonia	6	
Lobar pneumonia	1	
Atelectasis	3	
Pulmonary edema	1	
Lung abscess	2	
Bronchopleural fistula	1	
Empyema	1	
Tuberculosis	1	
B. Wound		
Infections	10	
Dehiscence	4	
C. Peritonitis	8	
Pelvic abscess	1	
D. Miscellaneous		
Gastrointestinal hemorrhage	3	
Pylephlebitis	1	
Parotitis, bilateral	1	
Delirium tremens	1	
Dextrocardia	1	
Syphilis	1	
E. Deaths	11	
II. No complications	54	(62.8%)

Hospital Stay. The shortest period of hospitalization following operation in the patients who survived was ten days and the longest period eighty-nine days. The average stay was 17.7 days. In the operative patients who succumbed (eleven) the shortest period of survival was one day, and the longest fifty days, with an average survival period of 8.5 days.

Mortality. There were eleven deaths in eighty-six operative cases, with a resultant mortality of 12.8 per cent. This is qualified by dividing the cases into two groups: first, according to age, and second, according to the duration of symptoms. Reviewing the former it is seen that the largest number of deaths numbering five out of fifteen cases (33 per cent) occurred in the sixth decade. This was almost half of the total number of deaths recorded, namely, eleven. Reviewing the latter it may be seen that seventy-four (86 per cent) of the patients were operated upon within twelve hours following the onset of symptoms. There were thirty-five cases (40.7 per cent) in the first six hours without a death, and thirty-nine cases (45.3 per cent) in the second six hours with seven deaths or a mortality rate of 18 per cent. It is apparent from these statistics that, in general, the younger the patient and the shorter the time between perforation and operation, the better is the prognosis. The longest interval between the onset of symptoms and operation was fifty-nine hours, recovery ensuing. There were no deaths in the five patients who received conservative treatment. This number is too small to justify any conclusions.

Follow-up Study. We have been able to trace twenty-eight cases: twenty-seven males and one female, and this covers a postoperative period varying between two months and five years.

Results obtained may be classified as satisfactory and unsatisfactory. In one of the cases in which a satisfactory result was recorded it was noted at the time of his last follow-up examination, which was two and one-half years following repair of his perforation, that for the previous six months he partook of ten glasses (10 oz.) of beer and ten glasses (1 oz.) of whiskey between 12 o'clock midnight and 4:00 A.M. in the morning. His occupation was that of a defense worker in a machine-shop and he worked from 3:30 P.M. to 11:30 P.M., and slept on the average of four out of twenty-four hours. Despite this he remains symptom free. In May, 1942, a gastrointestinal series demonstrated the presence of a duodenal ulcer.

There were nineteen cases classified as satisfactory and nine as unsatisfactory. In the former group are included all of the patients who were treated conservatively. In the latter there were two cases which had repeat perforations within six and seven months, respectively. In each instance following the first operation periodic attacks of pain and nausea with associated vomiting occurred. Following the second repair one of the patients remained asymptomatic for four months, after which he

noted attacks of pain with vomiting every three or four weeks over a period of three months. These symptoms abated spontaneously, since which time he has been well. In the remaining case the patient still has recurrent attacks of abdominal pain, nausea and irregular attacks of vomiting. In four cases subsequent gastric resection was performed for persistence of symptoms. Three of the patients had resection performed within three months following the perforation, and the remaining patient one year following the perforation. Follow-up of these cases revealed the patients under dietary management to be completely asymptomatic. The remaining two of the unsatisfactory group have been followed for three years. One has never felt well since the operation, despite adequate and persistent medical treatment. The other felt well for one year, following which there was periodic recurrence of pain unrelieved by medical care. Both of these cases are incapacitated relative to their normal occupation.

SUMMARY

1. Ninety-one cases of gastroduodenal perforation have been reported, eighty-six treated by operation and five by elective conservative management.

2. Fifty-seven cases were gastric in origin and in twenty-four duodenal. In three the location was undetermined; in another it was in the jejunum and in one it was equidistant on either side of the pyloric vein.

3. The predominant symptoms and signs have been reviewed. The similarity in some cases to acute appendicitis and points of differentiation from the latter have been discussed.

4. A review of the cases referable to age, duration of symptoms, and mortality has been presented.

5. Shock was rarely associated with perforation. It was present in only four (4.4 per cent) of the cases reported.

6. Roentgenograms were taken for free air beneath the diaphragm in forty-one instances and was positive in thirty-five cases (85.3 per cent).

7. The order of frequency of postoperative complications were respectively, pulmonary, wound infections and peritonitis. In fifty-four of the cases there were no complications.

8. Drainage of the peritoneum or the wound is not recommended.

9. The immediate preoperative and postoperative treatment of the operative cases is considered.

10. A detailed discussion of the conservative management of gastroduodenal perforation has been given with individual case reports of the patients treated in this manner.

11. In eighty-six patients operated upon there were eleven deaths (12.8%). There were no deaths in the five patients treated conservatively. In general the variation in mortality is in direct proportion to the age of the patient and the duration of symptoms.

12. A follow-up study in twenty-eight of the operative cases is presented.

This includes both operative and non-operative cases.

SNAPPING HIP

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THERE is not much mention of the snapping hip in the general surgical textbooks. In fact, most of them pass this condition over with only three to four lines which fail to enlighten one as to exactly what it is or how to treat it. The literature is not very large and most articles report only one or two cases seen. I believe that there must be many of these hips seen, especially in industrial practice and among young active males, but these are either being overlooked or not diagnosed. The symptomatic cases manifested by pain and limp can be corrected by a simple, safe operation which gives almost 100 per cent cures.

I have six cases to report, two of which were seen by me in association with Dr. Fred A. Turner. The other four were seen on the Orthopedic Service of the Station Hospital, Camp Bowie, Texas. Out of 2,600 cases seen on this service since January 1, 1941, these four had all of the definite symptoms of snapping hip, an incidence of 1 per 650 admissions. All six cases seen were young males.

History. The history of this condition is very indefinite so far as the early medical literature is concerned; so I shall pass over it without further discussion.

Etiology. There is some question as to the etiology of this condition. Some claim it may possibly be due to an inflamed bursa about the hip joint or trochanter, malformation of the hip joint, tic or spasm of muscles, either voluntary or involuntary, or muscular relaxation, especially of the gluteus maximus. While Mayer, Pruitt, Lovett and DaCosta believe it is due to iliotibial tract abnormality.

I consider the cause to be due to trauma to either the iliotibial tract or the tensor fasciae femoris and possibly at times to the insertion of the gluteus medius muscle. However, the majority of the cases follow injury to the iliotibial tract alone.

Cases I, II, III and IV have definite histories of hip injuries which were later followed by the appearance of snapping in the injured hip. Case VI gives an indefinite history of injury, while Case V has had no injury so far as I could find out.

I believed that these men received vertical tears in the iliotibial tract in the region of the greater trochanter and that the healed scar in the tract formed a hard ridge which whips back and forth over the greater trochanter with each step. This eventually causes a bursitis over the trochanter which causes both local and referred pain.

Symptoms. The symptoms are very simple. The patient complains of a snapping, which he can feel and occasionally hear, in the region of the greater trochanter. There may or may not be pain. It was present in four of my cases. Pain is always present in the region of the greater trochanter and may be referred down the anterolateral aspect of the thigh to the knee. Two patients (Cases II and III) thought that the effected leg was shorter than the other. In fact, Case II had been told that he had a dislocated hip.

Physical Findings. There is a palpable "cord" whipping over the greater trochanter which goes anterior to on flexion of thigh and posterior to the trochanter on extension. This may be easily felt by placing the hand on the trochanter and having the patient walk. It is usually present with each step. Occasionally the "cord" may be seen to jump under the skin during locomotion. In old cases with severe pain and muscle spasm (Case II) there may be atrophy of thigh muscles and slight scoliosis as the patient favors the leg to ease pain.

Some patients lie in bed so that the injured leg seems upon observation to be shorter than the uninjured one. Measurement from the anterosuperior spine of the ilium to the internal malleolus will show that both legs are of equal length. An anteroposterior and oblique views of hip should be taken. In true snapping hip there is no bone change.

Diagnosis. A diagnosis is made by: (1) Palpable snapping of band over the greater trochanter upon flexion and extension of the hip; (2) pain in the region of the trochanter may or may not be present. There may be occasional referred pain to the anterolateral surface of the thigh; (3) no bone changes are shown by *x*-ray; (4) legs are of equal length; and (5) usually there is a definite history of trauma either remote or recent (four of my cases), but absence of this will not rule out the correct diagnosis.

Differential Diagnosis. This must be made from osteochondroma of the trochanteric region, intra-articular lesions such as loose bodies or osteochondromatosis, or subluxation associated with paralysis of the muscles of the hip. All, with the exception of muscle paralysis, show positive *x*-ray findings. Muscle paralysis may be differentiated by history, muscular weakness, and physical findings.

Treatment. The correction is surgical if pain and disability are present. If there is only snapping without pain and disability, no surgery is indicated as an explanation of the cause will usually satisfy the patient.

The operation should be done under local anesthetic as the tense band is found with difficulty if the muscles are fully relaxed by inhalation anesthesia. Dickinson reports a case of bilateral snapping hip which required five operations, three under ether, and the last two, which were successful, under local anesthesia. It is very important that the patient be conscious and able to snap the hip during operation, otherwise the band will often not be found and the patient will not be cured.

The technic used was that described by Campbell which is as follows, (Figs. 1, 2, 3 and 4): "An incision is made in line with the junction of the gluteus medius and tensor fasciae femoris muscles to the posterior border of the greater trochanter, thence continued distally in the longitudinal axis of the thigh a distance of 4 inches. On incising the ilio-tibial band, a definite, thickened strip may be palpated on its posterior inner surface. This portion is dissected up to the trochanter forming a flap 3–4" in length. The distal end of the tensor fascia femoris is then freed. The distal half of the fascial flap is cut off and the remaining fascial flap is transferred anterior to the greater trochanter, sutured to the fascia on the anteriolateral aspect of the thigh and fixed by chromic sutures." (Fig. 4.)

The leg is not immobilized in a cast as was formerly the practice, but a snug, tight dressing is applied to prevent any postoperative oozing. It is a good idea to use a soft rubber drain for a few days as there is a large area of skin that has been undermined. Exercise should be started as soon as the wound has healed.

Several other operations have been suggested by Binnie, Jones, Mayer and Pruitt, but they are essentially the same as the above described technic and the results also are the same.

CASE REPORTS

Case 1. E. A. D., age seventeen, a male, while playing football six months ago fell down pinning his left leg under him. There was sharp pain at the time of injury but not disabling. On the next day his hip and lateral side of thigh were sore but he soon recovered and after ten days was able to resume play. Three months after injury he began to have snapping of hip when he walked. At first there was no pain associated with this, but as snapping became more severe there was associated pain in the anterior and lateral side of thigh which extended down to the knee. The patient believed his left leg was shorter than the right and he favors it. He was very worried about the leg and thought that he may be crippled and unable to play football. Physical examina-

tion showed a typical snapping hip. Legs were of equal length; there were 1½ inches of atrophy in the left thigh; *X*-ray was negative. Operation was carried out under local anesthesia and the thickened iliotibial band resected. The patient recovered completely and his football ability was not impaired.

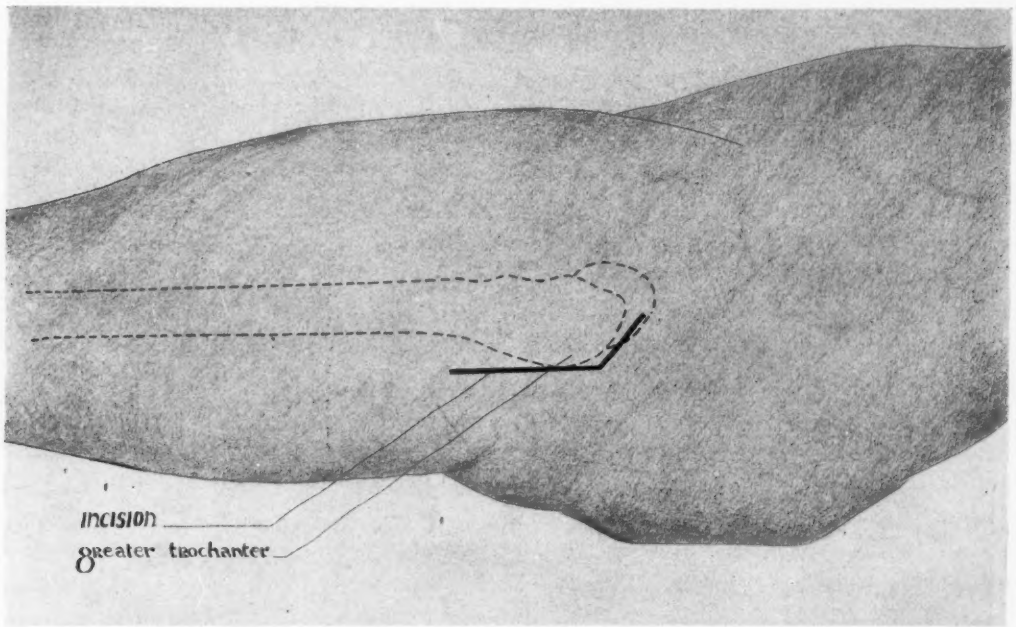

FIG. 1.

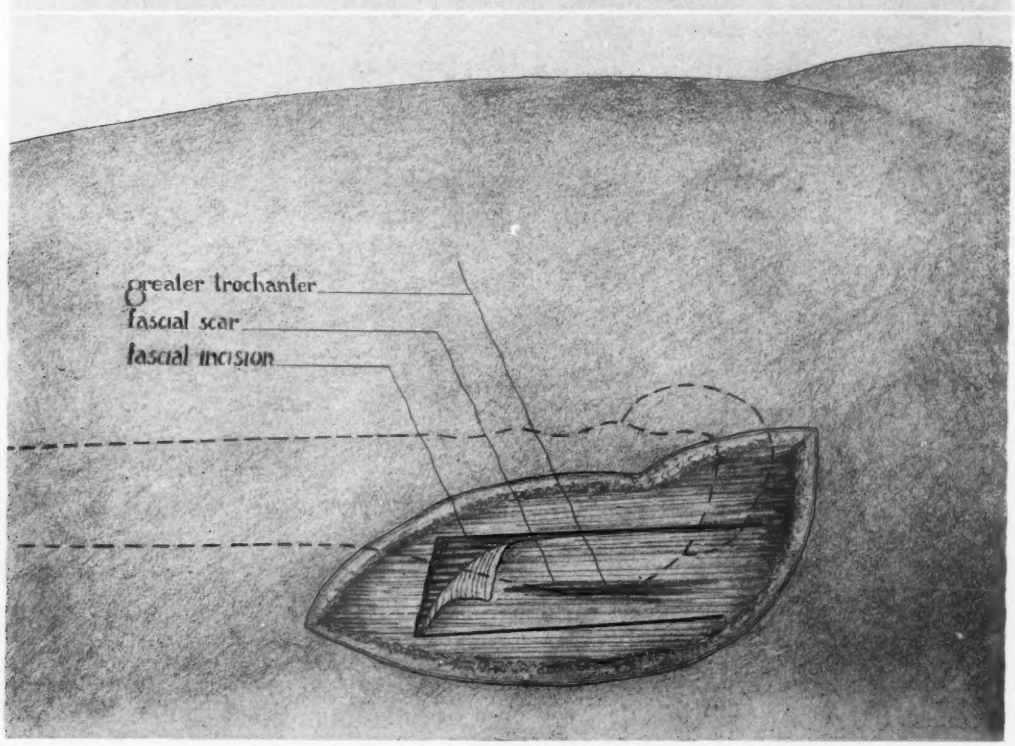

FIG. 2.

FIG. 1. Skin incision is shaped like a hockey stick and is made in line with the junction of the gluteus medius and tensor fascia femoris muscles to the border of the greater trochanter, then distally and parallel to the femur for about four inches.

FIG. 2. Two parallel incisions are made in the iliotibial tract and extended up to and above the greater trochanter where the gluteus medius and tensor fascia femoris gradually fuse into the tract. The thickened fascial band, which causes the snapping, is shown in the drawing and can be felt on the posterior inner surface of the iliotibial tract as a thickened cord.

CASE II. O. C. T., age thirty, injured his hip when he slipped and fell while running to the mess hall. His left leg was twisted. The regi-

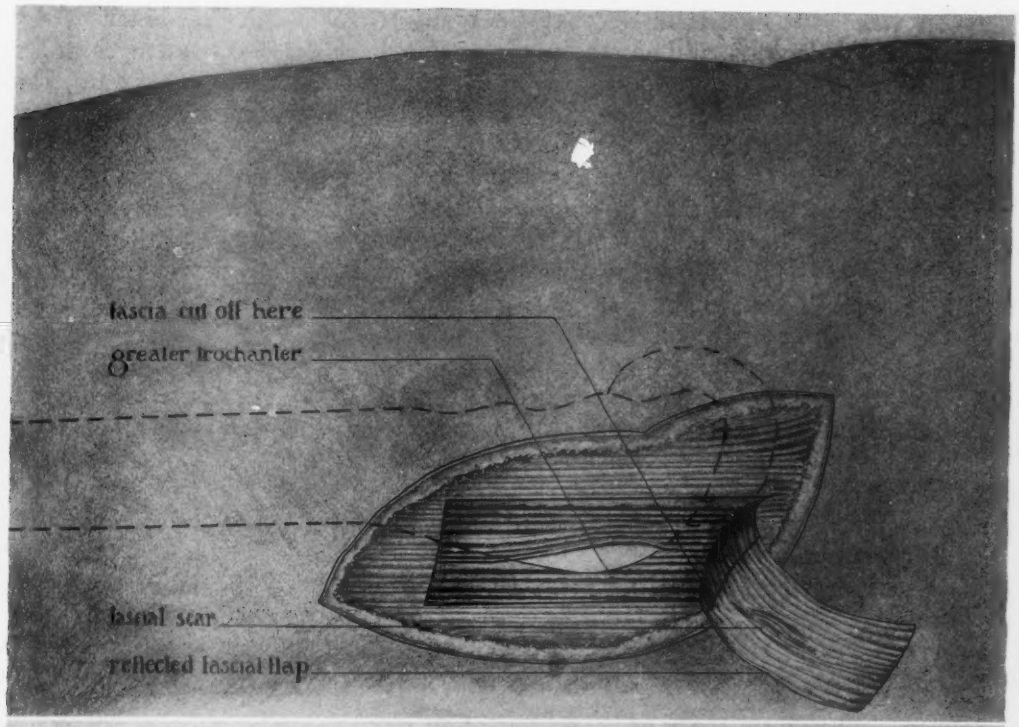

Fig. 3.

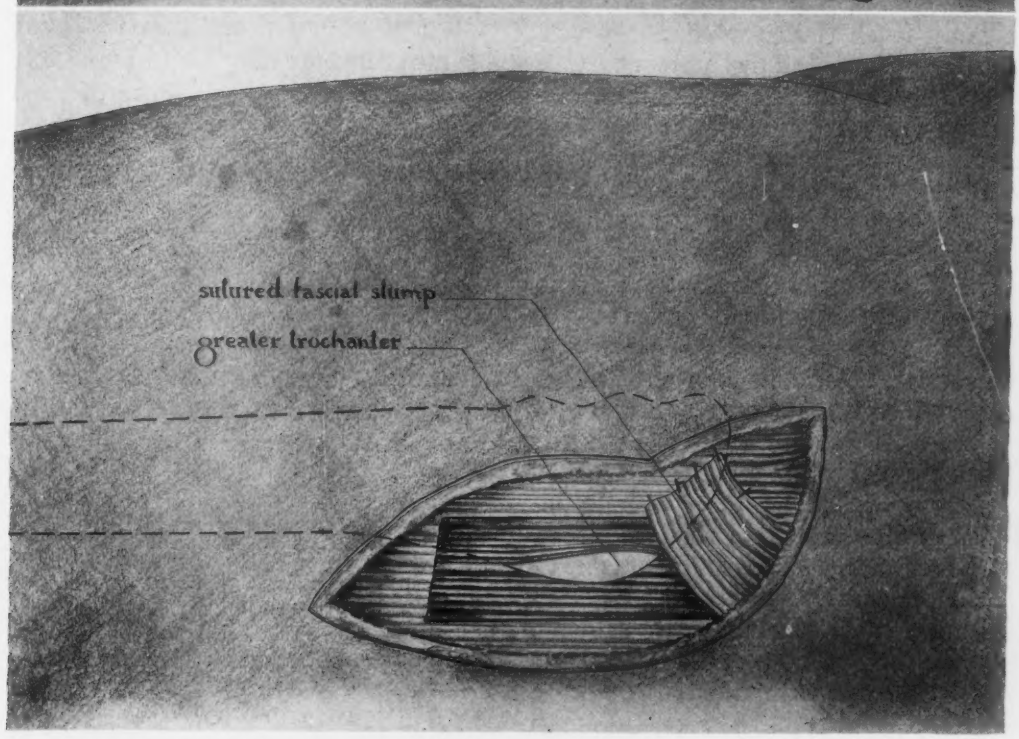

Fig. 4.

Fig. 3. The fascia between the parallel incisions is dissected up and freed from the greater trochanter, thus also freeing the distal end of the tensor fascia femoris. The distal end of the flap is freed and turned back as shown. The distal two-thirds of flap cut off as shown by black line in above figure.

Fig. 4. The proximal one-third of the fascial strip is sutured anterior to and above greater trochanter to fascia of anterolateral surface of thigh. This absolutely prevents any further snapping of the hip from occurring. Defect in fascia is not closed.

mental surgeon who saw him thought that he had a possible hip dislocation and on admission to the hospital it had that appearance. *X*-ray was negative. There was no limitation of motion and no swelling, but he was unable to stand straight because of pain in the leg. The injured leg appeared shorter than its mate but was the same length on measurement. There was no popping. The patient was treated by bed rest. Four weeks later a slight snapping appeared in the left hip and gradually became worse with associated anterolateral thigh pain which was referred to the knee. This patient was badly disabled and unable to perform even the lightest military duty. At operation there was a thick iliotibial scar which was almost like cutting cartilage. Campbell's repair was done and the operation was a success. The patient is slowly recovering as he had a great amount of atrophy of the left thigh. No snapping or pain are present.

Case III. M. C. K., age twenty-seven, injured his back and right hip during a blackout when an army truck turned over. *X*-ray was negative. All physical findings were negative on admission. Twenty days after the injury he began to have snapping of the right hip. This grew worse since walking was started and there was pain in the region of the trochanter. This patient has been advised to have surgical correction but as yet it has not been done.

Case IV. P. V., age twenty-one, began to have snapping of the right hip four months ago, but pain did not appear until six weeks ago. There was snapping and pain in the anterolateral surface of thigh, greater trochanter and knee. At times he feels that the right hip is shorter than the left. He is beginning to have painless snap in the left hip also. There is no definite history of injury but it may have been due to a minor injury he received on march four months previously. Physical examination showed definite snap which is both palpable and visible on the right hip and a slight snap over the left. *X*-rays were negative for both hips. He was advised to have an operation on the right hip but refused.

Case V. L. D. C., age eighteen, a male, experienced snapping of the right hip with every step which began three months ago. It was painless. No progress has been in this condition since the first month of onset. No definite history of injury was given. The snapping band is easily felt over the trochanter. *X*-rays were negative. Legs are of equal length and there is no atrophy. As there was no pain, the pathology was explained and an operation was not advised. The patient was satisfied and he has had no further trouble with the hip.

Case VI. L. P. M., age twenty-two, began to notice a popping of hip in the region of the greater trochanter whenever he took a step in winter of 1940. He had no pain. He felt the pop but did not hear it. There was no history of recent injury; however, in 1938, while playing football he received an indefinite hip injury which partially incapacitated him for two weeks. There was definite snapping on extension and flexion of hip. The thickened band can easily be rolled between the fingers of the examining hand. Legs are of equal length and there is no atrophy of thigh muscles. *X*-ray is negative. As there is no pain, an operation will not be advised. The patient, who is in the service, returned to duty.

In the above cases I have given only the most important points and have tried to touch only the high spots of each case. Two patients have been operated upon successfully, one awaits operation, another was advised to have surgery but refused, and in two no operation was indicated.

SUMMARY

Six cases of snapping hip are reported. The etiology, symptoms, physical findings, diagnosis, differential diagnosis, and operative technic are described. The results are given.

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SUBASTRAGALOID ARTHRODESIS FOR THE OS CALCIS TYPE OF FLAT FOOT*

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IT will be necessary for the average orthopedic surgeon to alter to a certain degree his concepts of surgical indications in the treatment of painful or symptomatic flat feet in order to appreciate fully the unusual satisfaction to be realized from applying the operation of subastragaloid arthrodesis where it is specifically indicated. After several years of critical observation of postoperative surgical results in the treatment of various types of decompensated or painful flat feet, the author's opinion of the various operative procedures has been amplified especially as to where certain operative procedures were best applied, and where these various operative procedures yielded inferior results. After analyzing these results following surgery in the treatment of flat feet for sometime, it chanced during the examination of a child with a severe degree of flat foot that the author noted a marked valgus of the heels, which is considered to be so commonly associated with malposture of the feet, if not flat feet. It was observed that if the rear foot was held manually in the correct position; in other words if the valgus of the os calcis was manually prevented, when the child bore weight on the foot, the depression of the longitudinal arch with prominence of the structures on the medial aspect of the foot, either the scaphoid or head of the astragalus, or both, did not appear.

The thought then occurred that if by some operative procedure the deformity of the rear foot could be prevented, why would it not be possible to maintain the height of the longitudinal arch and prevent the commonly seen depression of the structures in the region of the medial foot, and the inward bulging of these same structures? Other patients were observed and examined with this thought in mind until it seemed convincing that such correction of and prevention of deformity would result from successful subastragaloid or subtalar arthrodesis. To date, the author has in the last four years performed, or has supervised performance on his service at the Children's Orthopedic Hospital in Seattle of about eight bilateral operations in which subtalar arthrodesis has been done, occasionally with simultaneous excision of a prominent accessory scaphoid bone, or subsequent excision of a remaining prominent or accessory scaphoid. The results from surgery in this class of patients has been the most uniformly satisfactory series of surgical results in flat feet experienced to date. In practically every case the result has been good or excellent. A few patients have some minor disturbances with the feet, but no serious return of deformity, while some of the feet have entirely normal appearance and apparent function. One of the first patients so treated has been able to walk as much as thirteen miles per day in the mountains in the summertime without difficulty. Reconstruction of the ligament holding the peroneus longus tendon in its groove was required on one side after the arthrodesis, however, in this first case.

What is the os calcis type of flat foot? Obviously, this condition is nothing new. However, if one will study the individual characteristics of the patient with foot complaints one will notice that in some of

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these patients the valgus of the os calcis is a definite and important part of the deformity of the foot. Regardless of any complex description of the mechanism and development of depression of the longitudinal arch of the foot in the weight-bearing position, it has become evident that one of the primary, if not the primary and initiating factor in the depression of the longitudinal arch in this type and the associated deformities of the flat foot lies in the occurrence of valgus of the os calcis when weight is borne. If the os calcis by weight bearing tilts into eversion or valgus, the head of the astragalus is permitted to gravitate medially in the horizontal plane, and having started in this direction undoubtedly soon, if not simultaneously, becomes plantar flexed in relation to the rear foot. The head of the astragalus then becomes very frequently prominent on the medial aspect of the foot, and if the foot is flexible, even more commonly the scaphoid bone also in addition to becoming depressed plantarward bulges on the medial aspect of the foot. How much actual abduction of the forefoot also in the horizontal plane occurs through the midtarsal region is very difficult to determine, but in a flexible foot this probably is an appreciable entity, since the forefoot in standing or in a certain portion of the gait is fixed.

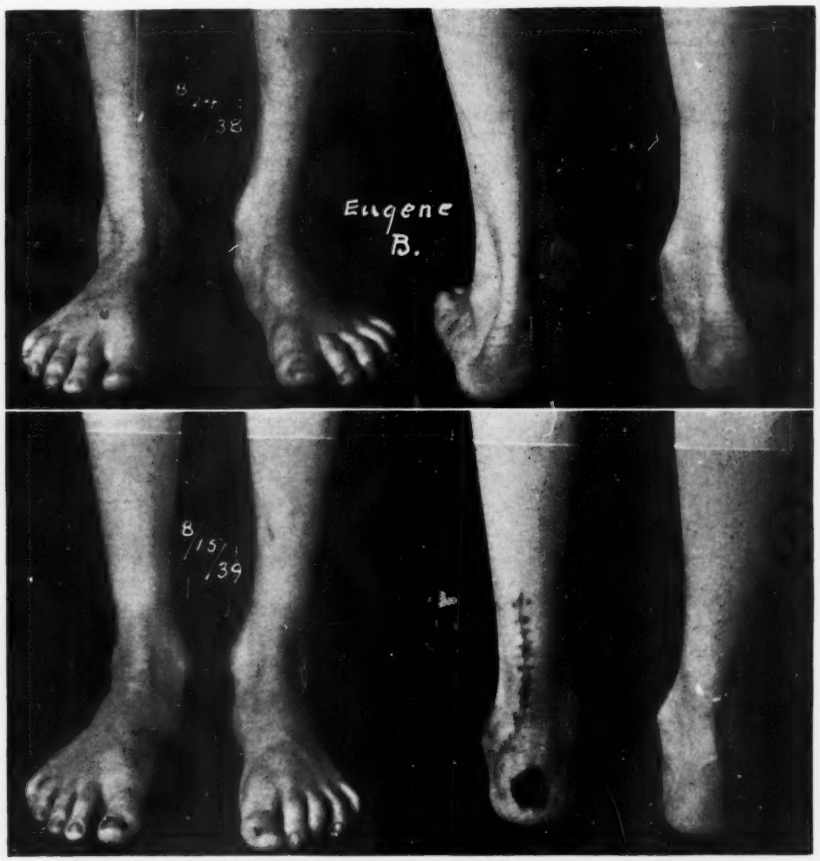

FIG. 1. E. B. A, preoperative and B, postoperative standing photographs. Note improvement in foot posture. Retenaculum peroneus longus reconstructed from a strip of the Achilles tendon, left.

Practical application of subastragaloid or subtalar arthrodesis has proved that where bony contour and anatomic size of the foot bones are normal, fixation of the rear foot in the neutral or straight position will prevent rotatory deformity of the talus, as well as the leg above, in the horizontal plane, and equinous or plantar flexion deformity of this bone. (Rather,

if the shape of the bones of the feet is within normal limits, subtalar arthrodesis will prevent the bulging of the head of the astragalus medially, and also the prominence of the scaphoid on the inner aspect of the foot and concomitantly also prevents depression of the longitudinal arch in the weight-bearing position.) If, however, there is a congenital prominence and deformity of the neck or head of the astragalus, and a congenitally prominent enlarged or accessory scaphoid bone, although the degree of protrusion of these structures on weight-bearing may be markedly decreased, it will be found necessary especially in the cases of the scaphoid protrusion to excise this fragment at the time or at a subsequent date. This is for the purpose of removing the prominence from the shoe irritation. In other words, not all feet in which scaphoid bone is very prominent, or in which an accessory scaphoid bone exists,

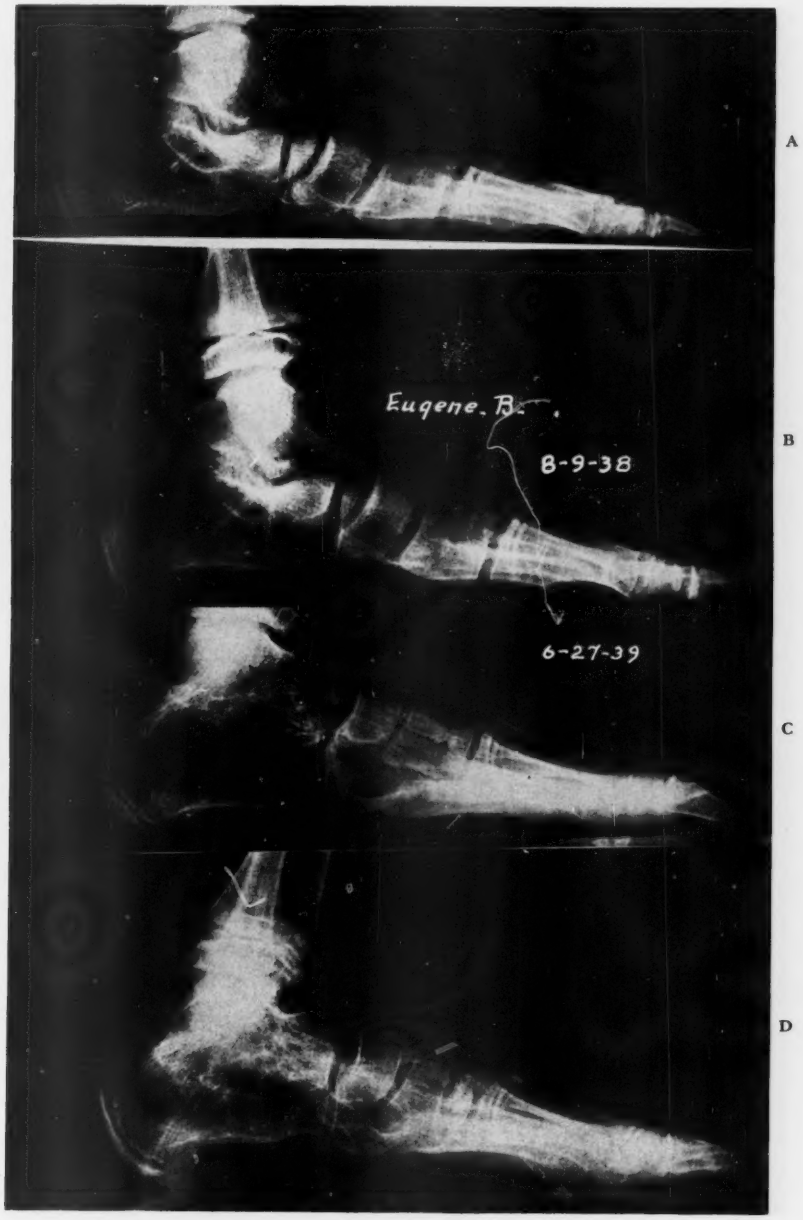

Fig. 2. E. B. A and B, preoperative; and C and D, postoperative standing radiographs, lateral views. Note subastragaloid arthrodesis, improved longitudinal arches.

A B C D

FIG. 3. E. B. A and B, preoperative and C and D, postoperative anteroposterior radiographs standing. Note some decrease in medial prominence of head of astragalus and scaphoid, right and left postoperatively.

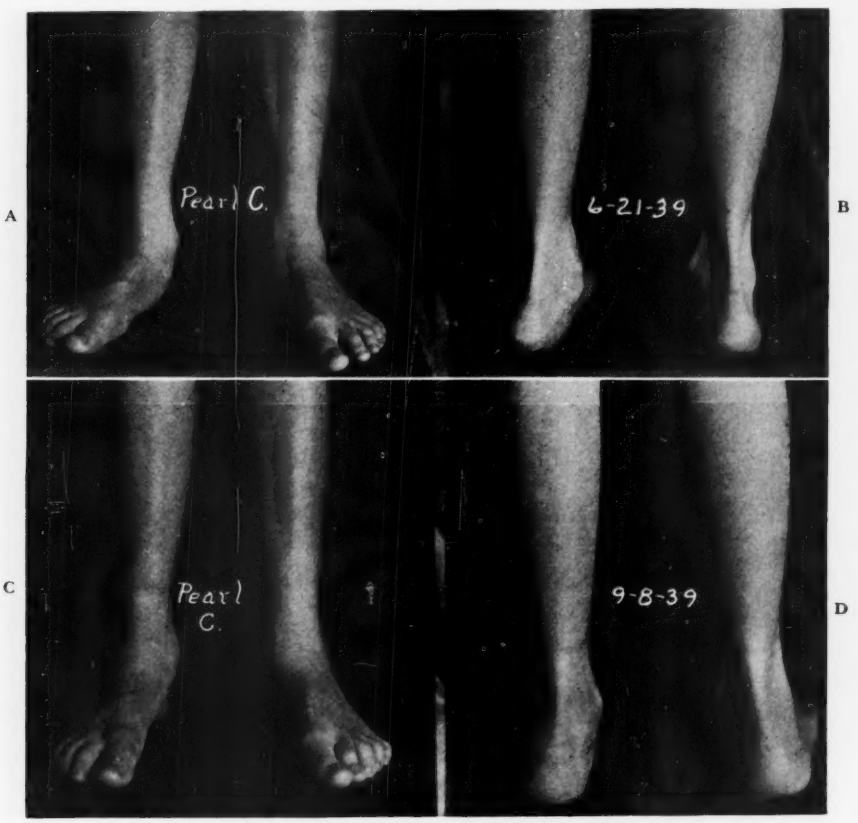

FIG. 4. P. C. A and B, preoperative and C and D, postoperative standing photographs. Note improved foot posture and increased height of longitudinal arches. Slight valgus of os calces apparent postoperatively.

are by any means flat feet, nor are they necessarily accompanied by symptoms of foot strain, but local pressure irritation may be the only symptom existing.

can be obtained in certain types of flexible flat feet by transference of the tibialis anticus tendon posteriorly, or possibly by other soft tissue surgery; but the

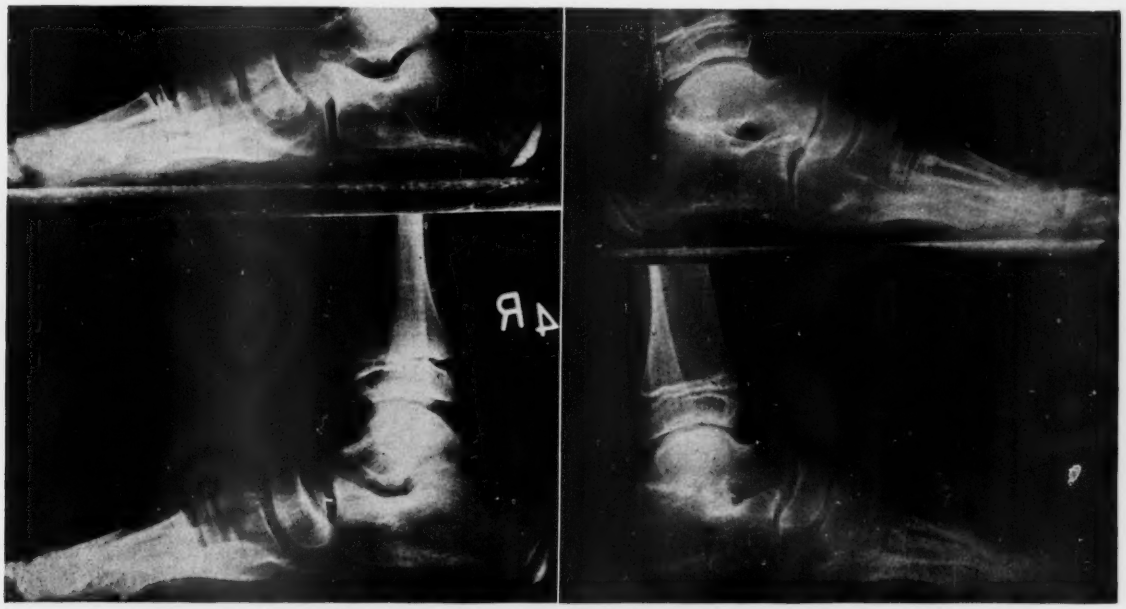

Fig. 5. P. C. Preoperative and postoperative lateral standing radiographs, postoperative showing subastragaloid arthrodesis and improved position of astragalus with higher longitudinal arch.

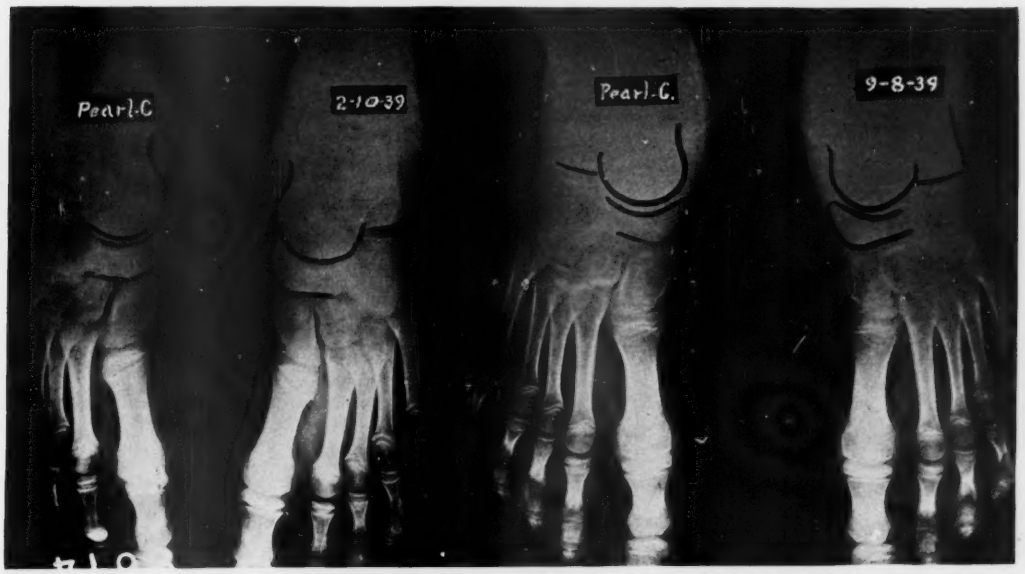

Fig. 6. P. C. Preoperative and postoperative standing anteroposterior radiographs, some change suggested less definite than lateral views.

A good deal is said and written about the inadvisability of disturbing the bony architecture of the foot or of removing the mobility of the foot joints when soft tissue work can be substituted. It is conceded that many excellent results

argument that interference with the joints of the foot is a factor of such importance that it should be avoided is, and has been proved by the results in the os calcis type or flat foot to be fallacious. The lack of instability in the rear foot is insurance

against repeated foot strain under function in which the foot has proved itself to be incompetent in the first place. Postoperative examination of the patients reveals that they have maintained a large percentage of the passive pronation and supination of the forefoot in the presence of fusion in the talocalcaneal or subtalar joint. That they do not have entirely normal or flexible excursion of pronation and supination in the anterior portion of the foot is a condition to cause probable

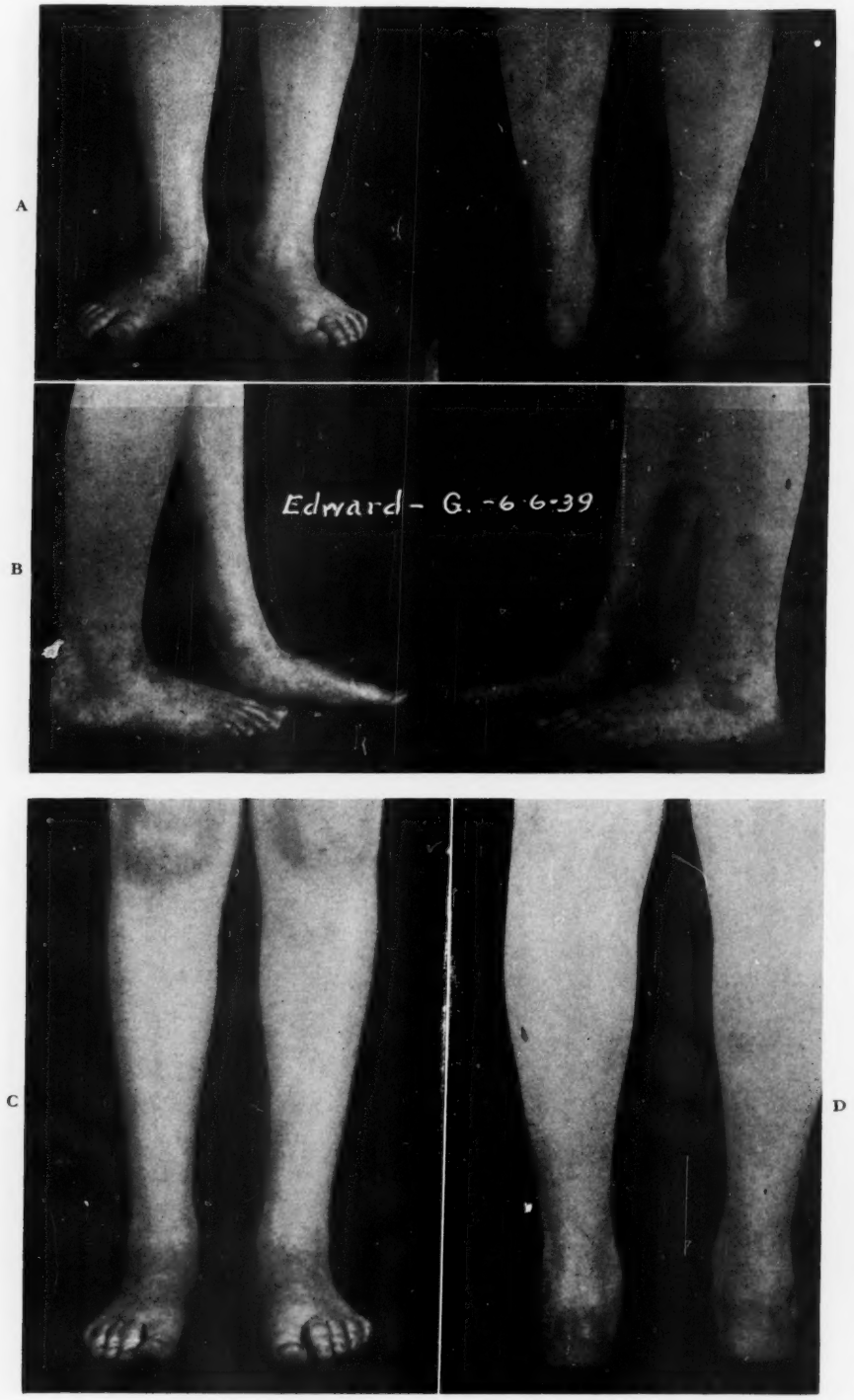

FIG. 7. E. G. A and B, preoperative standing photographs; C and D, postoperative standing photographs.

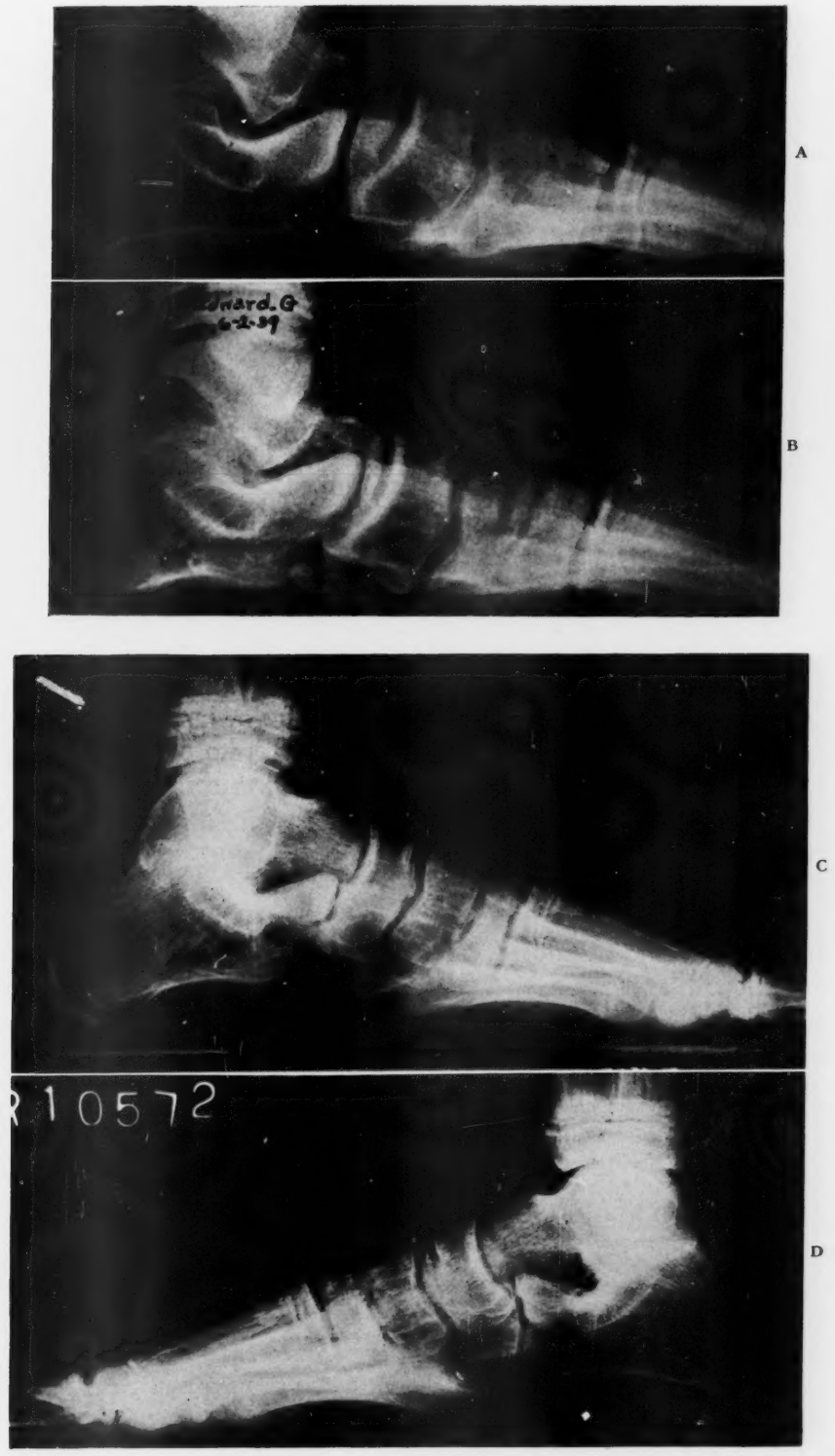

Fig. 8. E. G. A and B, preoperative standing lateral radiographs; C and D, postoperative lateral standing radiographs. Note resultant increase in longitudinal arch and higher position of scaphoids and head of the astragali.

rejoicing in years to come. Until the present time the author has not performed this operation for the painful os calcis type of static flat foot in adults, but its possibilities are not restricted to this type of flat feet in children.

The operative procedure is certainly not new. The recognition of the type of symptomatic flat foot in which valgus or eversion of the os calcis is the initiating deformity is comparatively simple, if it is considered. The operation itself because of the limited exposure is not easier than a triple arthrodesis, and at first may seem more difficult to the operator. Ordinary care will prevent appreciable injuring of the midtarsal joints. It is unnecessary to remove a wedge as the resting posture of these feet usually approximates normal. If the bony surfaces are deeply chipped and held in the neutral position until fusion occurs, subsequent deformity should be prevented. After the first few operations it was noted that the relative position of the head of the astragalus with reference to the anterior tubercle of the os calcis was better preserved in the postoperative non weight bearing radiograph when the foot was markedly inverted and adducted with some plantar flexion; but since fixed varus of the posterior foot is a very undesired complication to subtalar arthrodesis, the author has habitually returned the foot to the walking position with the heel neutral in approximately three weeks. Two or more months of plaster immobilization with a subsequent period of longitudinal arch support were carried out. While preoperative standing radiographs made from the lateral aspect have shown the head of the astragalus to lie at a much lower plane with relative overriding of the shadow of the anterior tubercle of the os calcis, postoperative radiographs have demonstrated a variable but uniformly higher plane of the head of the astragalus; and the long arch also is apparently higher. In the anteroposterior standing radiographs there is suggested, but less clearly, improvement in the outward swing or abduction of the forefoot, especially through the midtarsal joints. The most visible evidence of correction in the postoperative photographs, which are certainly variable in judging postoperative results, show decrease or absence of the valgus of the heel and marked tendency for recession of the prominent structures in the medial aspect of the foot, particularly in the patients in whom accessory scaphoid prominences are not present. In one instance the author attempted to pin the neck of the astragalus to the os calcis in the correct position by a Kirschner wire, but this first trial was apparently not anymore successful than on the side where plaster alone was used, although the patient had definitely less discomfort in this foot postoperatively than in the other side.

The following preoperative and postoperative photographs are presented to demonstrate some of these patients without special regard for choosing those considered most satisfactory. (Figs. 1 to 8.)

CONCLUSIONS

1. The os calcis type of flat foot may be defined as a postural deformity of the foot in which apparently valgus or eversion of the rear foot initiates and is responsible for the subsequent deformities associated with depression of the longitudinal arch.

2. Functional deformity of the os calcis type of flat foot without abnormal congenital protrusion or deformity of the head of the astragalus and especially of the scaphoid can be prevented by subtalar arthrodesis.

3. Symptoms of decompensation or foot strain accompanying this type of flat foot can best and most satisfactorily and permanently be corrected by subtalar arthrodesis.

4. It is sometimes necessary to remove the abnormal prominence of the scaphoid bone.

WELL THIGH TRACTION IN THE TREATMENT OF INTERTROCHANTERIC FRACTURES

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AND

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THE problem of reduction of intertrochanteric fractures has always been a serious one. Maintenance of reduction has also presented difficulties. Because most of the patients admitted to the Orthopedic Service of the Philadelphia General Hospital are aged and debilitated and over seventy years of age, hospital care and extended periods of hospitalization aggravate the basic critical problem.

In an attempt to solve the problem as a whole, we considered it necessary to accomplish the following: (1) Adequate reduction; (2) suitable fixation; (3) simplified nursing care; (4) simple operative procedure; (5) freedom of hip and knee motions, and (6) low cost apparatus.

Reviewed and considered were the merits of such existing methods as: (1) Open operation; (2) pin and screw fixation, and (3) well leg traction and fixation—Roger Anderson well leg splint and well leg casts with struts.

operation, for example, in the type of cases we are called upon to treat, is too shocking

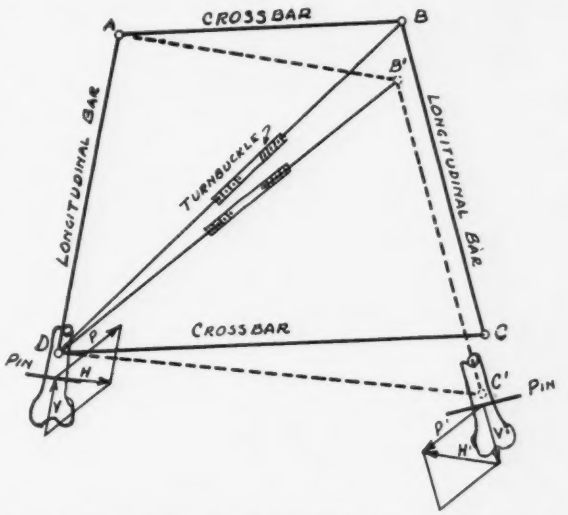

FIG. 1. Illustration showing the scheme of the apparatus and an analysis of the forces.

a procedure to warrant serious consideration. It was, therefore, dropped.

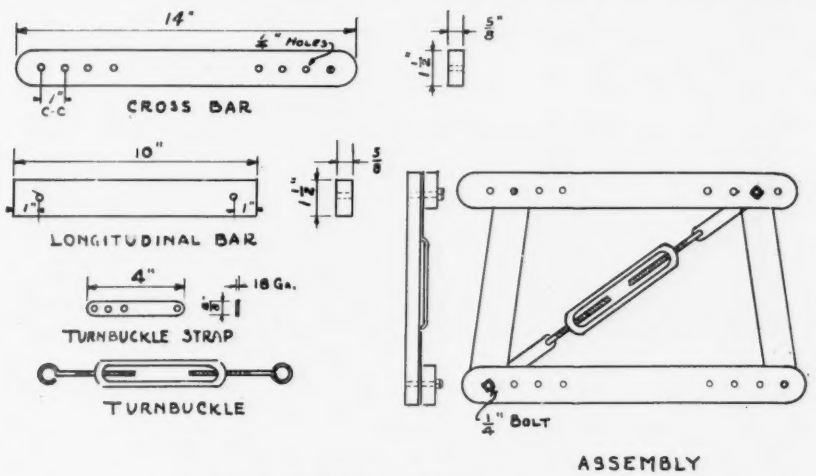

FIG. 2. Scale drawing of the apparatus.

Definite limitations appeared in the survey of these available technics. Open Pin and screw fixation may be suitable in some cases. In many of our patients, how-

ever, the site of the fracture and the demineralization of the bone do not make the use of this method feasible.

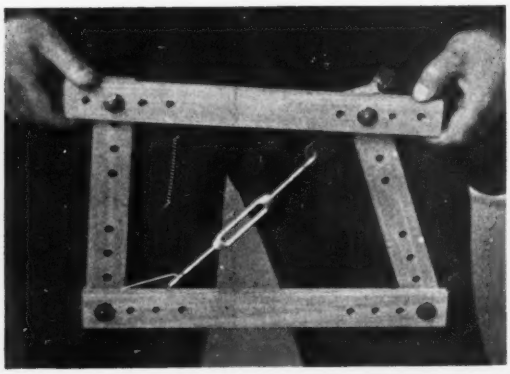

Fig. 3. Photograph of apparatus.

The high cost of a large number of apparatus must not be overlooked when it is considered that there are about ten or twelve of these cases in our wards at one time. At least a dozen pieces of this apparatus is therefore required. To avoid this initial expense, the solution is to be found in an inexpensive apparatus, but one which is effective and efficient.

The Roger Anderson well leg traction apparatus provides a very satisfactory method for control of these cases. Unfortunately, here, too, there are drawbacks. It meets all but the last two requirements in our specifications. Although the Anderson apparatus allows motion of the hip joints, the knees are fixed and have a tendency to "glue up." Although it is not an expensive piece of equipment, if one case alone is involved, a heavy outlay of money is called for when ten or twelve apparatus are needed.

Fig. 4. Photograph of apparatus as applied to patient.

In discussing this problem with another of the orthopedic chiefs at the hospital, we learned that Dr. J. R. Moore used the Anderson well leg apparatus with a pin part way through the femur rather than through the tibia on the fractured limb. In this way traction on the ligaments of the knee was eliminated and a subsequent relaxed joint obviated.

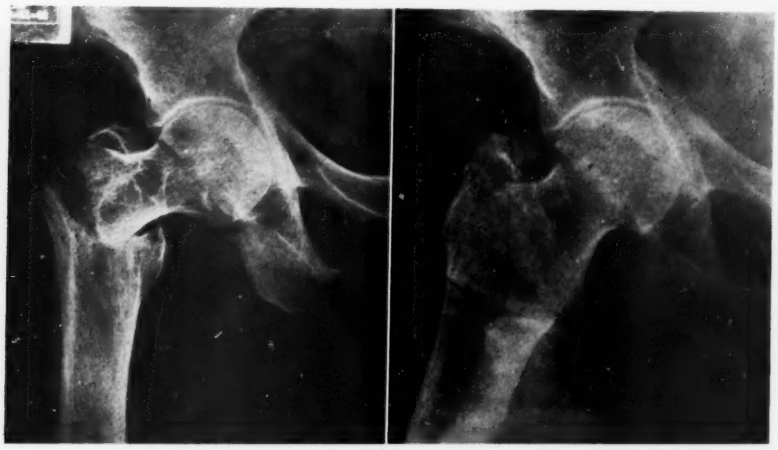

Fig. 5. Fig. 6.

Figs. 5 and 6. B. Z. Intertrochanteric fracture before and after application of apparatus.

After further study of the whole picture a solution was presumed whereby both knees could be left free and traction and pressure applied through pins at the lower ends of the femora. To accomplish this a mechanism to provide the necessary forces and fixation was devised.

The materials used are as follows: two cross bars—Maple, birch or waterproof plywood; two longitudinal bars; four machine screws and nuts; four washers; one turnbuckle and two pieces of 5/8 inch by 4 inches—18 gauge strap iron.

TECHNIC

1. Local anesthesia is preferred. Steinman pins sufficiently long to extend one inch to one and a half inches beyond the skin margins are used. These are inserted approximately one inch above the abductor tubercle of the femur. They are placed in the coronal plane perpendicular to the shaft.

2. A felt pad, three inches wide, one-half inch thick and long enough to almost reach the pin on both sides of the thigh is placed just proximal to the superior border of the patella. This in turn is held in place by cotton sheeting wrapped around the thigh. Except for this padding, the plaster is applied directly to the skin.

3. The casts are applied from the knee to the groin. Care must be taken, however, to place the plaster high on the lateral surface of the fractured thigh.

FIG. 7. P. H. Intertrochanteric fracture.

4. Place the longitudinal bar (Fig. 1) on the anterior surface of the well thigh cast in the sagittal plane. Embody this link in the plaster and fix it to the pin.

FIG. 8. P. H. Intertrochanteric fracture following application of apparatus.

5. Place the longitudinal bar (Fig. 2) on the anterior surface of the fractured thigh cast fifteen degrees lateral to the sagittal

plane and fix it to the cast in similar fashion. This is to provide the internal rotation necessary to align the fragments.

6. The patient is returned to the ward and the plaster is allowed to dry.

7. The turnbuckle assembly is placed from the proximal bolt on the fractured thigh to the distal bolt on the well thigh. The cross links are placed and the nuts are screwed down on the bolts. It is necessary to rotate internally the fractured thigh to place the crossbars. This can be accomplished with little pain if gradual firm traction is used while internally rotating.

8. The turnbuckle is tightened and a roentgenogram is made. If reduction is not complete, additional tension is applied through the tightening of the turnbuckle.

SUMMARY

A discussion of the problems in the treatment of intertrochanteric fractures of the femur is presented.

Specifications for a suitable apparatus are outlined; a description of the mechanism and design are shown; the technic of application is given and the fractures and their reduction are shown by the roentgenograms.

This paper is a preliminary report and end results are not indicated.

ANY phalangeal joint may be dislocated backward, forward or laterally. Reduction is by traction and bending the finger in the direction opposite to the dislocation. Occasionally, repair of the capsule is necessary to prevent recurrence of the displacement.

From "A Manual of the Treatment of Fractures" by John A. Caldwell (Charles C. Thomas).

THE SYNDROME OF THE FIXED OMENTUM*

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ATTACHMENT-FIXATION of the great omentum produces a guy-rope action of this structure upon the stomach, duodenum, transverse colon and diaphragm. The tension exerted by this relationship induces the signs and symptoms which characterize a separate and distinct clinical entity. I refer to this entity as "The Syndrome of the Fixed Omentum."

ETIOLOGY

The normally free margin of the great omentum can become fixed under a large number of conditions, the principal conditions being: (1) To incisional scars; (2) to inflammatory masses; (3) to raw peritoneal surfaces, and (4) herniation and incarceration into hernial sacs.

The extent of fixation attachment varies considerably in regard to the total surface of the omentum involved and in regard to the region of the omentum which becomes attached. This varies from attachment-fixation of the "total" surface, in tubercular peritonitis, to that of a single taut, cord-like strand of fibrous omentum, the violin-string adhesive band.

Traction of this fixed point on the walls of the stomach, duodenum, transverse colon and diaphragm induces the symptom-complex. The severity of the symptoms of the syndrome depends upon the direction of the traction and upon the resting tension of the attachment-fixation.

I have seen a strand of omentum fixed to the right ovary after partial oophorectomy; fixed to the entire posterior surface or fundus of the uterus; incarceration-fixed in inguinal, femoral, umbilical, lumbar or incisional hernias, to the sigmoid colon, the cecum, a McBurney incision, a midline incision or the various other regional incisions, fixed to an appendix, to a Meckel's diverticulum or diverticulum of the sigmoid colon, and to malignant growths.

PHYSIOLOGY: PRODUCTION OF GASTRIC PAIN

The innervation of the stomach consists of the pressor and depressor fibers of the autonomic nervous system. The sympathetic innervation transmits impulses to the celiac plexus, thence to the seventh, eighth and ninth thoracic cord segments and from there to the midbrain. The receptors are not in the cerebral sensorium and, therefore, do not record pain. These fibers transmit a reflex stimulus to the muscles and to the cutaneous structures supplied by these dorsal cord segments, with resultant reflex muscular rigidity and cutaneous hyperesthesia limited to the epigastric region. The sympathetic fibers record fulness and discomfort but do not record pain.

The parasympathetic fibers convey impulses to the sensorium of the brain and can, therefore, record painful sensations. The stomach records sensitively the fact that it is full; it is relatively insensitive to heat, to cold and to touch. Increased tension of the gastric wall induces pain, nausea and vomiting. During an operation upon the stomach, under local anesthesia, the surgeon can handle the stomach without producing untoward symptoms to the patient. Traction upon the stomach

* Extracted from "The Bedside Diagnosis of Surgical Lesions of the Upper Abdomen; Omental Fixation; Comments on Gastrointestinal Surgery." Presented before the Staff and invited guests of Laird Memorial Hospital, Montgomery, West Virginia, January 28, 1942, and before the Staff of the Myers Clinic, Phillipi, West Virginia, March 11, 1942.

induces pain, nausea, vomiting, bradycardia and general vagotonia.

An increased tension of the gastric wall sufficient to induce pain results: (1) From distention of the viscus from within (pulsion tension); (2) from spasticity of the muscular wall of the viscus (intrinsic tension), and (3) from traction on the viscus from without (traction tension).

Distention of the stomach beyond the limits of "active" physiological relaxation, as in the late stages of acute gastric dilatation, distention of the leather-bottle and hour-glass stomachs, and distention of the stomach when chronic diffuse gastritis or when diffuse malignant infiltration is present, all represent types of pulsion-tension. Pain during the filling phase of gastric digestion characterizes these conditions.

Spasticity of the musculature of the stomach wall results from localized inflammatory infiltration, as in ulcer or eroded malignancy, from acute hyperperistalsis of the stomach, as illustrated by sudden obstruction of the pylorus, duodenum or jejunum, and by the resistance to peristalsis of polypoid growths of the stomach. Pain during the emptying phase of gastric digestion characterizes these lesions.

Traction on the gastric wall results from ptosis of the transverse colon when this organ is abnormally distended with fluid; from fixation-attachment, either of the wall of the stomach to a stationary tissue or of the appendages of the stomach to a stationary tissue. This applies especially to the omentum, the attachment-fixation of which is our chief concern in this communication.

ANATOMY

The stomach lies suspended in the upper abdomen by the anlages of the dorsal and ventral mesogastrii. The ventral mesogastrium, or lesser omentum, incorporates the structures of the liver. Its suspensory function of the stomach is brought about by the transmission of its traction to the suspensory ligaments of the liver, which attach to the diaphragm and to the anterior and posterior abdominal walls. The lesser curvature of the stomach is suspended, therefore, either directly or indirectly from the diaphragm by the meso-esophagus, the hepatogastric ligament, the flaccid lesser omentum and the hepatoduodenal ligament, which arises from the ventral mesoduodenum. The ventral mesoduodenum overlies only the proximal duodenum and it bounds the foramen of Winslow anteriorly. Below the foramen of Winslow the duodenum is attached, by fusion, to the parietal abdominal wall overlying the right kidney and the lateral margin of the diaphragm.

The great omentum develops from the dorsal mesogastrium by an overgrowth, which is out of all proportions to the demands of gastric rotation on this structure. The anterior and posterior layers of this dorsal mesogastrium fuse together and this structure subsequently fuses with the transverse mesocolon, suspending the transverse colon from the greater curvature of the stomach. Fusion of the great omentum extends laterally to the diaphragm, beyond the flexures of the colon, and it aids in the suspension of the colon at the flexures.

Traction on the great omentum, therefore, is transmitted to the greater curvature of the stomach and of the duodenum, to the walls of the stomach and of the duodenum, to the lesser curvature of these structures, to the lesser omentum, to the liver and, from thence, to the diaphragm. The traction is transmitted to the transverse colon and from this structure to the diaphragm by way of the suspensory ligaments at the flexures of the colon.

The greater curvature of the stomach occupies a station in the abdomen considerably lower when the stomach is empty than when it is full. When the lumen of a distended stomach forms an oval ten inches in circumference, its diameter is approximately three inches. This section of the stomach when collapsed would form two flat, opposed surfaces five inches broad. At

this cross-section of the stomach, therefore, the attached great omentum would assume a station two inches lower in the abdomen when the stomach is empty than when it is distended. It can be seen that, should the free margin of the omentum become attached in the lower abdomen when the viscus is empty, any attempt to elevate the greater curvature of the stomach, either by distending the organ with food or by stretching would result in a guy-rope action of the great omentum on the stomach. This guy-rope action induces an increased tension on the structures of the stomach wall, which is productive of a painful dyspepsia of the "traction-tension" variety.

This tension is accentuated by any further separation of the fixation points of the stomach, that is, the fixed lesser omentum and the fixed region of the great omentum. Stretching, lifting, deep expiration or pressure exerted transversely across the abdomen, above the level of the omental fixation, will accentuate the tension. The tension is reduced, the symptoms being alleviated, by the approximation of the fixation points of the stomach, as in the act of "doubling-up," vomiting and deep inspiration.

CASE HISTORY

The syndrome of the fixed omentum presents the following phenomena:

1. These patients complain of a full-stomach, painful dyspepsia; the pain occurs in the epigastrium.

2. They feel a traction-discomfort in the lower part of the abdomen when they stretch, as in reaching for an object upon a high shelf; the region of the traction is, usually, readily located.

3. They have frequent episodes of nausea and vomiting, immediately after eating. Vomiting relieves the pain and distress.

4. The traction-discomfort is frequently accompanied by epigastric pain and nausea. This is especially noticed when the patient lifts a heavy object or elevates the arms above the head, as in stretching.

5. Attacks of intestinal colic are common and a history of audible borborygmi is the rule.

6. The symptoms are absent when the stomach is empty, except when positive tension is constantly evident. They are relieved when the patient lies on his side and flexes the knees on the abdomen, when the food intake is limited to fluids or to small quantities of solids, or when the patient induces vomiting.

7. These patients are usually well nourished; they do not present the clinical picture of an organic lesion of the gastro-intestinal tract, with the progressive onset of wasting and debility, without remission. These patients have remissions of symptoms and frequently go for considerable symptom-free periods by controlling their diet and habits. In this series of cases, the shortest history obtained was one of fifteen weeks; the longest history obtained was one of thirty-four years.

8. These patients frequently complain of compression of the chest, palpitation and pains in the chest. Deep inspiration relieves the condition, whereas, deep expiration accentuates it. This class of symptoms (cardiorespiratory) is noted principally in cases of positive tension.

9. A history of previous abdominal surgery, of the presence of hernia or of an abdominal crisis, in the recent or distant past, is usually obtained.

PHYSICAL EXAMINATION

The physical signs can be elicited by tests based upon the mechanical nature of the lesion.

When the recumbent patient is instructed to attempt to assume the sitting posture without using his arms, retraction upward of an abdominal escher is frequently observed. Lower abdominal eschars are frequently observed to retract to such an extent that the panniculus overhands the upper reaches of the eschar. An incarcerated omentum will occasionally reduce a scrotal hernia into the abdomen when this test is effected. Retraction of this variety can be felt as well as be observed.

When the patient stretches, as in reaching for an object upon a high shelf, the symptoms are induced or accentuated.

When the patient lifts a heavy object the symptoms are induced or accentuated.

Distending the stomach with food or drink induces the symptoms; stretching further accentuates the symptoms and "doubling-up" relieves them.

Deep expiration, while the patient "stretches," induces the heart and respiratory "compression" symptoms, especially in positive-tension cases.

Transverse compression of the abdominal wall above the fixation level induces epigastric pain, nausea and lower abdominal traction discomfort.

These patients are reasonably well nourished; they have a stable nervous background; and they accurately localize the pain in the epigastrium and the traction-discomfort in the lower abdomen.

X-rays taken of these patients are reported as "negative." A lateral *x*-ray of the stomach, when distended with barium, shows a tendency toward a fusiform outline instead of an oval outline. A flatness or plateau is frequently observed instead of the rounded dome of the diaphragm when the patient stretches during fluoroscopic examination and exhales.

Stasis in the right half of the colon is frequently noted, due to the compression of the transverse colon against the spine. I have no proven instance of a duodenal stasis due to pressure of this variety but such is possibly the case.

Auscultation demonstrates hyperperistalsis of the stomach, small bowel and the right half of the colon. This finding disappears after the patient has "doubled-up" for an interval.

DIFFERENTIAL DIAGNOSIS

This syndrome must be differentiated from the full stomach dyspepsias, which conditions include: stenosis of the pylorus of the stomach, partial obstruction of the small or large bowel, diffuse gastritis, diffuse malignant infiltration, leather-bottle and hour-glass stomachs, gallbladder disease, chronic passive congestion and visceroptosis. By the same token, this syndrome must be recognized when it accompanies other intra-abdominal lesions. This is exemplified by the case which presents an incarcerated omentum in a hernia sac; transfixation and transplantation of the sac without releasing the omentum serves only to make permanent the symptom-producing fixation.

This syndrome frequently accompanies peptic ulcers. This group of patients attempts to keep small amounts of food in the stomach by frequent small meals. Whether or not the tension produced on the gastric wall by the omental-fixation contributes to the production of peptic ulcers, is a matter of conjecture.

TREATMENT OF THE FIXED OMENTUM

The resting-tension of the fixation determines the ultimate choice between nonsurgical and surgical management of the individual patient. The degrees of resting-tension of the fixed omentum are divisible into three clinical groups: (1) Those with *lax-tension*, in which cases conservative management is all that is needed; (2) those with *taut-tension*, in which cases conservative treatment is given a trial, with the necessity of surgical intervention and imminent probability; and (3) those with *positive-tension*, in which cases surgical release of the omental-fixation is the only means of relief.

Discreet re-peritonization of all denuded surfaces and the correction of the co-existent lesion (such as hernias, malignancy or inflammatory lesion) are essential duties of the surgeon for proper conclusion of the procedure.

Conservative management is applicable to groups 1 and 2, the objective being to reduce the traction-tension of and to maintain as much laxity of the omentum as is possible. The following instructions are given to the patient: (1) Eat smaller quantities of food at each meal; eat more frequently; (2) avoid roughage foods (liquids and soft foods rapidly leave the stomach and cause less distress); (3)

maintain a soft stool by means of mineral oil, psyllium seed or similar medication; (4) during distressing intervals limit food intake to liquids; (5) dietary instructions, insuring an optimal vitamin intake and, if indicated, weight reduction; (6) when it is possible to elevate the abdominal parietes in the region of the attachment-fixation and by so doing relax the resting-tension of the attachment-fixation, a properly constructed corset should be fitted to the patient; (7) when necessary, either to prepare the patient nutritionally for surgical release of the omentum or to build up a debilitated patient, the patient is instructed to lie on the right side with the knees flexed on the chest for forty-five minutes to one hour after each meal.

Surgical management is applicable to groups 2 and 3, the objective being to release the omentum, re-establishing its normal status of free mobility in the abdominal cavity, and to remove the traction-tension from the structures of the stomach wall.

In releasing the fixed omentum I have abandoned the sharp dissection in the white plane of cleavage. I amputate the omentum in such a manner that a minimal amount of omental tissue is left at the site of the fixation. This residual omental tissue presents a smooth peritoneal surface, its demand for a blood supply is small and the graft is already successfully established. I suspect that considerable of the fat of this resident segment eventually undergoes absorption and that subsequently only a smooth eschar remains.

The vessels of both the resident segment and of the proximal, released margin are transfixed with very fine sutures, care being taken to incorporate the minimal amount of tissue with each vessel. The margin is then "rolled" upon itself, and secured by means of a fine continuous suture, in such a manner that no raw surface of the omentum remains exposed.

CASE REPORT

Case I. Miss Helen P. complained of fulness, gas, nausea and vomiting after meals; upper abdominal pain, and lower abdominal traction discomfort after meals. These symptoms had been progressive since a bilateral salpingectomy, left oophorectomy and right partial oophorectomy had been performed fourteen months before. She had suffered an acute, lower, right abdominal pain, of extreme severity, of a colicky nature, accompanied by severe vomiting, for six hours before admission.

The patient stood with the chest flexed on the abdomen. Attempts to straighten up intensified the pain, nausea and colic. When the patient reclined and doubled up the acute symptoms partially subsided. On auscultation, vigorous peristaltic sounds, localized in maximum intensity in the right lower quadrant, were heard. The abdomen was soft. On bimanual examination, a mass was palpable in the region of the right pelvic adnexa. *Preoperative Diagnosis:* Omental fixation in the pelvis; acute ileal obstruction.

Operative findings were a cord-like, fibrous strand of omentum, attached to the remains of the right ovary. A loop of ileum was incarcerated beneath this fibrous strand. This strand was dissected carefully from the surface of the ovary and the incarcerated ileum liberated. The strand was removed by a partial amputation, of this region of the omentum, the cut margin of the omentum being rolled and sutured in such a manner that no raw surface presented. No further pathological condition was noted on careful examination. The patient's recovery was uncomplicated and she has had no untoward abdominal symptoms since.

Case II. Mr. John M., Jr., age nineteen, stated that he had had attacks of epigastric pain, fulness, belching, nausea and vomiting following his meals, since early childhood. These attacks were related to the size of the meal eaten and tended to occur more readily and more severely when solids were eaten than when liquids were drunk. He had been treated for a number of years for pylorospasm without improvement. He was unable to obtain employment because lifting, driving an automobile or stretching induced his symptoms and disabled him.

On examination a large, congenital scrotal hernia was found on the right side. This hernia reduced itself when the patient laid recumbent and extended his arms over his head. At operation a firm, fibrous fixation-attachment of the omentum to the hernis sac was found. Release of the omentum and repair of the

hernia has rehabilitated this young man to full occupational activity, with no recurrence of his symptoms.

Cases III and IV. Two patients presented a similar clinical picture, which proved to be due in each instance to compression of the transverse colon against the spinal column by the fixed omentum. Classical signs and symptoms of omental attachment-fixation were present in each case. In addition, each patient presented signs and symptoms of chronic, partial obstruction of the transverse colon. In each instance a barium meal almost completely stopped in the midregion of the transverse colon and a barium enema progressed normally to the midregion of the transverse colon but halted there as long as the patient remained recumbent. When the patient was turned to a right-sided Sims' position, the distress diminished and the column of barium passed readily to the cecum.

When these patients were operated upon, Mrs. H. A., Sr., presented an attachment-fixation of the omentum to the entire posterior surface of the uterus and to the sigmoid colon; Mr. D. W. presented a fibrous attachment-fixation of the omentum to a Battle's incision in the right lower abdomen. Careful abdominal explorations, in each instance, revealed no other pathologic process in evidence.

Case V. Mrs. D. C., age forty-five, who weighed 262 pounds, presented a large, lower-abdominal, midline, postoperative ventral hernia. She had extreme omental fixation signs and symptoms, which were relieved by the tight application of a corset before arising each morning. At operation the abdominal cavity was entered to the left of the hernia sac and the fingers were passed upward and medially between the omentum and the anterior abdominal wall. Pressure was exerted on the anterior surface of the omentum and this structure was found to be taut and under considerable tension. By exerting pressure upon the anterior surface of the omentum wretching was repeatedly induced.

Case VI. Mr. W. J. Eleven months prior to admission, this patient submitted to surgical repair of a right indirect inguinal hernia. Subsequent to this operation, he experienced an intensification of his original symptoms and, in addition, developed an ulcer dyspepsia. Examination revealed a complete clinical picture of omental fixation; *x*-rays demonstrating a duodenal ulcer were obtained. At operation the omentum was found to be firmly attached to the incisional eschar. The released omentum presented a black silk suture. The hernia sac had been transfixed and transplanted with the attached omentum incorporated in the suture. A satisfactory response to medical treatment of the ulcer made it possible for this patient to return to full occupational duty without symptoms or distress.

SUMMARY

1. The syndrome of omental attachment-fixation has been presented.

2. The production of the symptoms of this entity have been explained.

3. A division into clinical groups has been advocated and methods of management presented.

4. A method of amputating the omentum is presented.

5. The differential diagnosis of this syndrome from other lesions is discussed.

6. Case reports are presented to illustrate various types of the clinical manifestations of the syndrome.

7. Further conclusions follow these facts: (1) The syndrome is a very common one. (2) More discreet closure of abdominal incisions is necessary, to prevent attachment-fixation of the omentum, as is also the discreet re-peritonization of raw intra-abdominal surfaces. (3) The unwarranted usage of intra-abdominal drains, unnecessary suture material or other foreign bodies must be sharply delimited. (4) The differential diagnosis of this syndrome from other intra-abdominal lesions makes the proper diagnosis of intra-abdominal pathological conditions more accurate and more inclusive, and provides assurance of surgical relief to a new and considerable group of patients. (5) Distinction should be made as to whether or not this syndrome complicates other intra-abdominal lesions; for example, when fixation-attachment of the omentum accompanies an intra-abdominal lesion, such as hernia. (6) In the preoperative analysis of these cases full consideration must be given to the estimation of bowel segment fixation and to eschar compression of the ureter.

HERNIOPLASTIC OPERATIONS UPON THE RECTUM AND PELVIC FLOOR

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WE cannot well discuss the above subject without considering the changes which eons of time wrought with three tail muscles to prepare the caudal end of the abdominal cavity to meet the extra demands of support in the upright position. These muscles have exchanged length, grace and agility, that were able to make a whiplash of the tail, for breadth and compactness and stability, that makes of the abdominal floor a bulwark of strength and yet a facile passage for the three important tracts which lead from the abdomen to the external world. A careful study has been made by tireless investigators in a series of animals as they represent the different degrees of the change to the upright position. The essentials of this change will be met for our present purpose if we can get a good understanding of the finished product. They are the pubococcygeus, the iliococcygeus and the ischiococcygeus, or coccygeus on each side blending into the levator ani muscles of the corresponding side. These cease to be individualists; they drop in part their coccygeal attachment, retain and amplify the circumference origin, and insert into the coccyx, into the median raphé between the coccyx and the anus, alongside the rectum and unite to the central tendon between the rectum and vagina, sending some fibers to the vagina and around the urethra. This makes then with the fascia above and below a broad complete musculofascial aponeurotic plate or griddle, which closes the lower wall of the abdomen—the pelvic floor—with tight clefts through which the tracts pass. In passage these tracts are grasped with snug fitting musculofibrous structures which decussate with the structures of the tubes, which so accommodate as to allow these tubes their functioning capacity, but which hold their walls in contact during periods of rest. The vast amount of work of adaptability over eons of time, carefully adjusted to furnish support and meet resistance and yet furnish easy passage to functioning processes would seem, if verified by the anatomist, physiologist and surgeon, to furnish an argument far too strong for the advocates of the prolapse of the rectum theory, namely, to take the rectum alone with its pathology, and encircle the anus with silver wire from below (Thiersch) or affix it to sacrum, abdominal wall, psoas muscle, broad ligament, etc., or cut it off without any thought or consideration of the pelvic floor.

It would seem that this finished product of nice adjustment after long centuries of preparation, has the rights of any other portion of the abdominal wall to claim, that when any organ in the abdomen has slipped its tether and passed through the cleft only intended for functioning passage, the dignity of recognition of a hernia and surgical restoration.

Prolapse of the rectum has not recognized over hundreds of years the necessity of the pelvic floor. The term "hernia of the rectum" recalls the work of vast centuries to prepare the pelvic floor to go with the rectum and look after its support and functioning. They belong together. The repair of one not only calls for the repair of the other, but the re-

attachment of the two is called for, which we must suggest has been overlooked in surgery of prolapse of the rectum.

and maldevelopment leave the pelvic floor weak. In a far greater number trauma and acquired weakness leave the pelvic

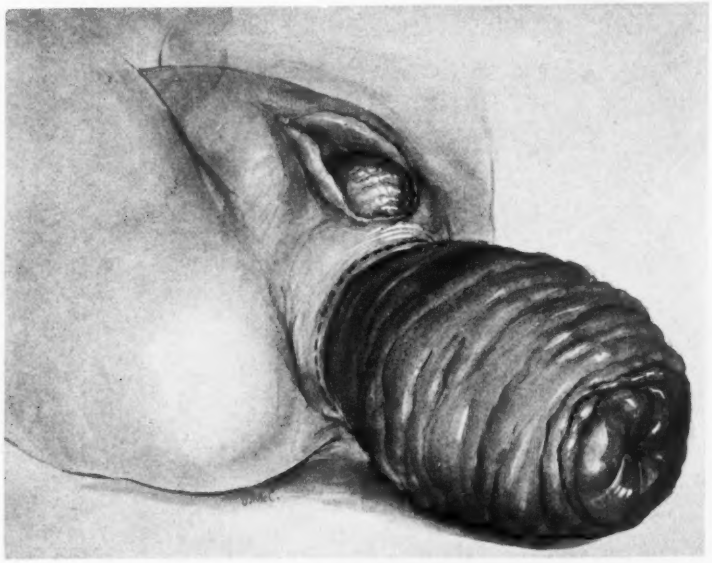

FIG. 1. Herniation of the rectum through the posterior cleft of the pelvic floor. A rectocele shows through the vulvar opening. This rectocele is increased in size when the herniation of rectum is reduced. Dotted lines showing incision at the mucocutaneous injunction.

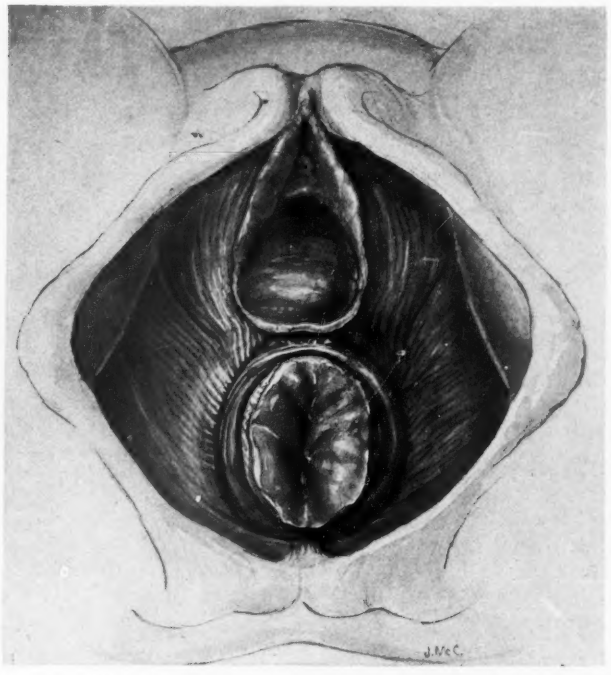

FIG. 2. Soft parts cut away showing greatly dilated sphincter and the levator muscles separated from pubis to coccyx from a case that would admit the hand or fist through the sphincter and pelvic floor.

The above arrangement for the support of the rectum provides for most cases, while in the minority, congenital defects

floor and its faulty attachment unable to withstand the combatting forces of frequent excessive strains, as in heavy lifting,

coughing, sneezing, straining with stone, stricture, enlarged prostate, constipation, diarrhea, etc., or pathological conditions which begin primarily or secondarily in the bowel itself.

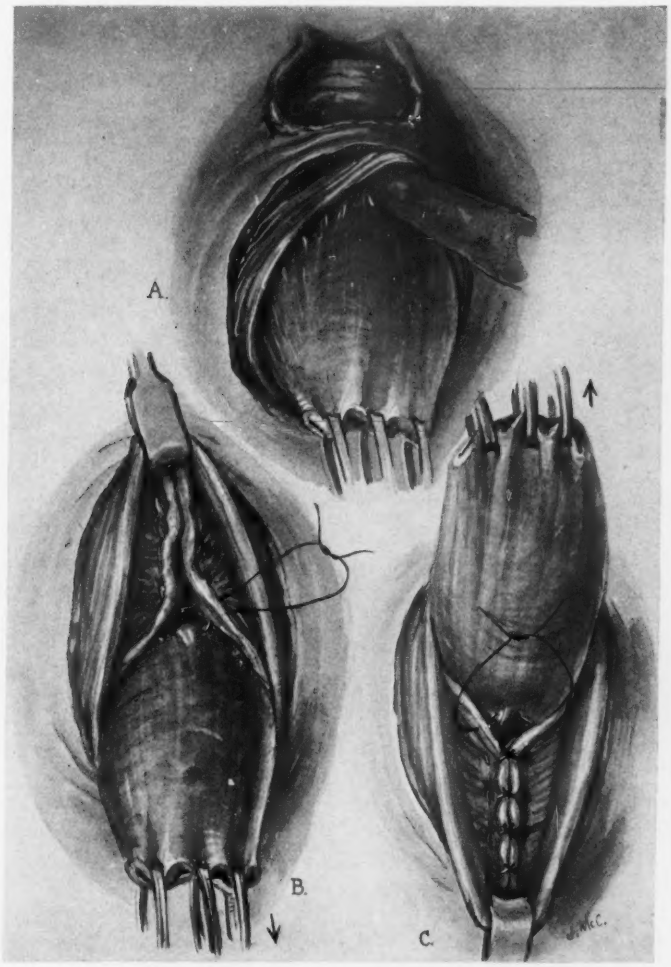

Fig. 3. A, the rectum being drawn down and sphincter being pushed back. As much rectum as thought necessary is removed. B, levator ani muscle being exposed through the sphincter muscle and being sewed anterior to the rectum. Mattress sutures being shown. C, rectum turned forward exposing the levator ani muscles posterior to the rectum, interrupted sutures here shown. Either suture may be used. In some extensive cases a line of mattress sutures and a line of interrupted sutures is used.

So the exigencies of the rectal and pelvic floor condition find us dealing with extrusions through the posterior pelvic floor slit with the rectal tissues becoming detached from the pelvic floor. This condition creates an increasing pathological disorder in both. The extrusion may be small, of a hickory or walnut size; of a medium size, that of an egg or orange size; or large size, that of a cocoanut or football or larger. The small or medium-sized ones may present fairly normal tissues and be ready for operation after a short period of preparation. The large ones are apt to be found in aged, weak individuals and exhibit extreme disorders, tardy to recover for safe operation. It is regrettable that any should reach the larger sizes of herniation. The smaller ones are much more amenable to ideal treatment, and the medium-sized hernia-

tions yield fairly well to preparation and operation. The treatment is based upon one's conception of the condition. If the

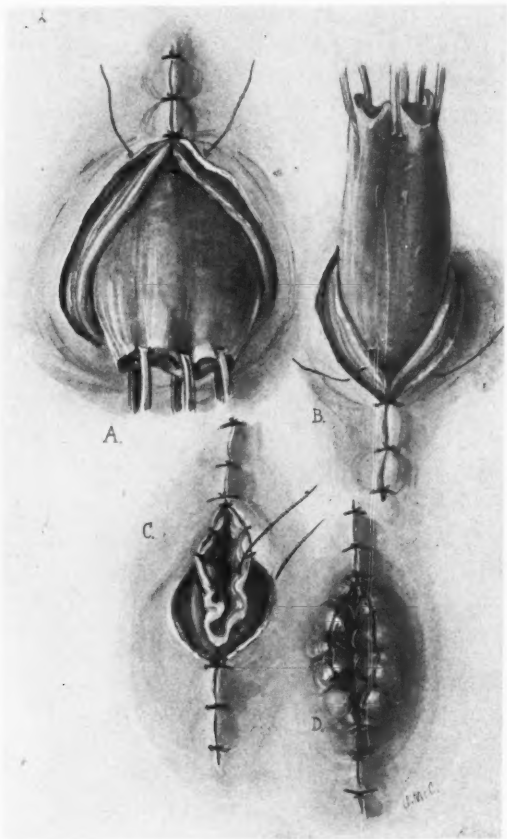

Fig. 4. A, shows rectum turned backward and sutures lessening the size of the skin and sphincter opening. B, the rectum turned forward showing the interrupted sutures lessening the size of the skin and sphincter openings posteriorly. C, shows rectum amputated and cut end being attached to the skin and sphincter on the sides. D, suturing of the skin and bowel completed leaving proper size sphincter and bowel opening.

treatment for prolapse of the rectum is, and always has been and will be directed at the bowel condition, the pelvic floor will be overlooked. If the condition is a herniation, the abdominal wall and the pathological status of the bowel will receive joint consideration.

In the determination of the correct surgical anatomy, we may well consider the words of Stone who says, "The term 'hernia' is used in general to designate the abnormal protrusion of organs or tissues through defects or openings that should enclose or confine them. . . . The factor of basic importance is not the sac or the contents, but it is the defect in the abdominal walls, floor or roof that allows protrusion of the abdominal contents." We have here then all the requirements of a hernia: a weakened wall and a gut pushing through. A hernioplastic repair of the pelvic floor, a bowel correction and an attachment of the bowel to the pelvic floor are necessary. This is accomplished as follows:

AN INTRA-SPHINCTERIAN HERNIOPLASTIC OPERATION UPON THE PELVIC FLOOR AND SPHINCTER, COMBINED WITH AMPUTATION OF THE HERNIATED PORTION OF THE BOWEL

1. Thorough preparation with as much preoperative improvement of the herniated structures as possible.

2. Anesthesia to suit the condition and the operator.

3. Lithotomy position, pelvis rather elevated and buttocks well over the edge of the table.

4. The herniation is preferably returned to pelvis, leaving the enlarged anal circle facing the operator like the face of a clock.

5. The cutaneo-anal junction is picked up with tooth forceps at the points 12, 3, 6 and 9 of the clock.

6. The line between 12 and 3 is put on the stretch and a sharp knife follows this line just inside the sphincter muscle; 3 to 6 is treated in the same way, then 6 to 9, then 9 to 12.

7. The cut end of the gut stands free in its whole circumference, when it is picked up by several tooth forceps and pulled toward the operator, while a knife severs any tough fibers and a sponge pushes back all structures surrounding the gut to the length that seems necessary to amputate the gut.

8. With the gut held intact, it is pulled backward as shown in the cut, and the sphincter is held forward while the enlarged pelvic floor ring is brought together

in front of the rectum with No. 2 interrupted catgut, the number of sutures varying from one to three, according to the size of the dilated ring. The posterior of these anterior sutures should take a grasp of the bowel at the level of the repaired pelvic floor.

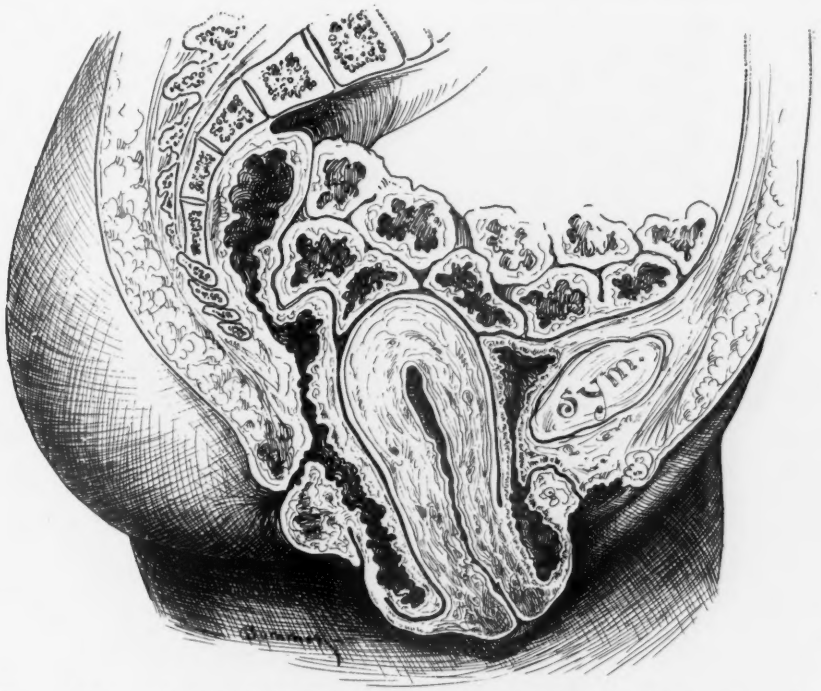

Fig. 5. Shows the rectal, bladder, uterine and peritoneal herniation through the anterior pelvic floor cleft. A little stretching of the sphincter in such a case would permit the rectum to herniate through the posterior cleft.

9. The bowel is now turned forward over the repaired pelvic floor and the posterior portion of the pelvic floor ring is closed as described, anteriorly, preferably with two more sutures than in front. The most anterior suture of these posterior sutures grasps the posterior bowel wall, after which the side wall of the bowel is sewed to the remaining side of the cleft or hernial ring.

10. The considerably enlarged skin and sphincter circle is lessened, bringing them together in front of the rectum and posterior to the same, with two more sutures in front and two less posteriorly, to give the lower end of the bowel a slant backward, after which reduction in size. The proper amount of herniated gut is amputated, the free end of the gut is united to the skin edges laterally and the operation is completed.

A smaller amount of gut will require amputation than is the case if no repair of sphincter and pelvic floor is done.

This now leaves only a healing by first intention to give a perfect functional and anatomical result. A moderate amount of suppuration may be compatible with a fair result.

The hernioplastic operation to cure rectocele is performed by raising the posterior vaginal flap and bringing the pelvic floor muscles and fascias together. Care should be taken to have the sutures reach far enough backward to get the muscles anterolateral to the rectum, in order to reduce the size of the cleft through which the rectum passes. Another precaution is to see that the anorectal structures are well attached to the supporting pelvic floor. In extensive bulging of the anterior rectal wall, transverse plication of the anterior rectal wall is recommended by Dannreuther, care being observed to avoid penetration of the bowel. It is of greatest

importance to use the muscles and fascias to reinforce such bulging rectal walls. Cases are seen in which a greatly stretched rectovaginal septum may at one time herniate through the anterior cleft, and at another herniate through the posterior or anal cleft. Here the excess of vaginal flap may easily be cut away, but plication is more applicable for the rectal wall, provided rectal amputation is not demanded. In cases of complete tear with excess rectal wall, the anterior rectal flap may be drawn down and amputated. Some conservative operators consider rectal operating taboo after a line of vaginal repair, but not infrequently rectal repair is a part of vaginal repair.

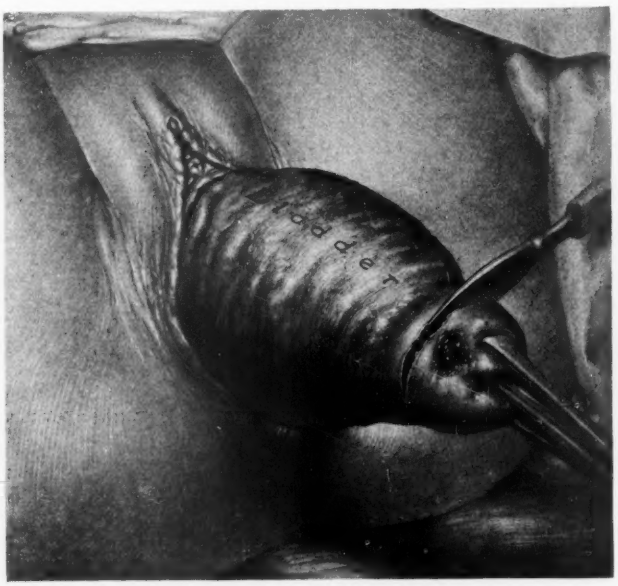

Fig. 6. Shows the same condition as is shown in cross section of Figure 5. Herniation of the uterus, bladder and rectum. With such loosening and coming down rectal herniation easily takes place.

Some pathologic conditions are not circumscribed by splitting the rectovaginal septum and some cases are found without a complete vaginal septum. I have in several instances amputated a moderately herniating rectum, and made a hernioplastic operation on the posterior cleft and sphincter, after a vaginal repair which included in some cases a vaginal hysterectomy. Cases and operators must be chosen for like extensive work and two sittings could well be chosen if the nature of the work could easily find a dividing line.

In cases not needing amputation, a strengthening of the pelvic floor and lessening of size of the sphincter circle is sometimes performed through a crescent-shaped incision, anterior or posterior to the anal opening. This procedure was elected in relaxed cases in Army work in France, and in one case of herniation with amputation, although the intrasphincterian hernioplastic repair would have been more suitable. Cuneo and Sénèque have more recently reported the method of anterior and posterior incision for reconstruction of sphincter control, but these alone are not applicable for herniation of considerable extent. Cunningham, Hartman and others have amputated the rectum without consideration of the muscle control. These cases could have the hernioplastic repair at the same time in a majority of cases, or at another time in extreme cases.

Cases could be appended to illustrate almost every phase of rectal herniation, but there are some cases that illustrate these herniations more than others. One

case that has come under my care so graphically demonstrates the hernial nature of the disorder and is so typical of development and means of relief, that it seems worthy of detail in place of a longer series.

A. G., age fifty-one, a doctor, formerly surgeon in the Russian Army, a well developed, athletic type, somewhat overweight, began to have herniation of the bowel when less than one year old. (Father had like condition as a child, but recovered.) Since then has never had a bowel movement without extrusion; extrusion and returns, two, three and four times before relief was obtained. Severe straining had developed double inguinal hernia. Each hernia had returned in a short time after operation had been performed by competent men. The patient, when a child, was taken to doctors by his father, but was advised to use temporizing means, hoping for improvement. Patient made a constant study of proposed measures of cure, but was not sufficiently impressed with the rationale. Over the years, and especially of late, the extruded mass became larger, and the sphincter perceptibly more dilated. More bleeding and more discharge was also noted.

The patient was impressed by the rationale of the intrasphincterian hernioplastic repair. After deciding upon operation, he took cleansing astringent enemas before entering the hospital and had four days' preparation in the hospital before operation. The bowel was kept inside by a large rectal catheter and antiseptic astringent solution was allowed to run in at frequent intervals. Sulfathiazole emulsion was used intrarectally and by external application. The rectal herniation was the size of a fist when the patient was brought to the operating room. Upon being reduced, the surface wrinkled and looked not unlike an overflowing cup of angleworms.

Operation was performed according to the method described. The wound closed, leaving a normal appearance, and healed by partial granulation. It was feared continence might not be perfect. The wound healing slowly, but in the end was well-nigh perfect. Sphincter control was good and the sphincter grasped the finger with force. Pelvic floor muscles, of the proper size were felt snugly grasping the rectum. The rectum has not extruded since the operation. Defecation and retention are normal, except slight leakage of liquid stools.

SUMMARY

1. We have undertaken to present these rectal extrusions as herniations through the pelvic floor.

2. The pelvic floor is the lower wall of the abdomen and as such is a support to the rectum when retaining its proper build and strength, and as a part of the wall is subject to weakness and hernial formation.

3. Hernioplastic repair of the pelvic floor and amputation of the extruded portion of the bowel is a rational procedure.

VESICO-INTESTINAL FISTULA—ACTUAL AND INCIPIENT

EARLY DIAGNOSIS AND TREATMENT

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THE subject of vesico-intestinal fistula has been frequently discussed in medical literature from a variety of angles. It shall be our purpose to treat this subject from the urological aspect, particularly with the view of emphasizing its early recognition in urologic diagnosis, and suggesting a few additional sidelights in treatment.

Fistulous communications between the bladder and the various segments of the intestinal tract are not uncommon, but still sufficiently infrequent to warrant comment. Higgins, for example, in 1936 was able to collect 583 cases, including thirty-five from the Cleveland Clinic. Kellogg, in 1938, reported 592 cases. Yet Balch, discussing Higgins' paper, stated that he was only able to find nineteen cases in going through the files of the record rooms of six Indianapolis hospitals having a total of 1,738 beds.

TYPES OF VESICO-INTESTINAL FISTULA

Higgins' grouping of cases is both simple and practical. He groups them as: (1) traumatic, (2) atraumatic or inflammatory, (3) tumors and (4) congenital. For our purpose we have found it somewhat more convenient to group the cases under two main heads, namely, (1) fistulas arising primarily from the bladder and (2) fistulas arising primarily from the intestine. Although this classification fails to take into account the group of traumatic cases as well as the small number of congenital cases, it is more pertinent to the text of this communication to limit our remarks to the groups of inflammatory and neoplastic lesions, since it is with these cases that the urologist is most apt to deal.

Fistulas may be actual or incipient. Actual or fully developed fistulas may occur in two forms: (a) direct communications between the bladder and bowel through short straight sinuses, and (b) long narrow tortuous sinuses connecting both viscera. The former is usually seen in cases due to carcinoma and tuberculosis, while the latter occurs most frequently in cases resulting from infections. Males are more frequently affected than females in the proportion of 3 to 1 (Pascal). The reason for this discrepancy has been attributed to the intervention of the uterus between the bladder and the intestine, and to the prevalence of diverticulitis of the sigmoid in the male. The greatest incidence is between the ages of fifty and sixty.

A careful analysis of the cases collected by Higgins, Kellogg and Balch seems to indicate that inflammatory lesions of the bowel constitute the underlying cause of the fistulas in the majority of cases (51 per cent), while tumors of the bowel were the underlying cause in 21.3 per cent. The bladder was the primary site of the lesion in 11.6 per cent of cases.

Higgins' statistics seem to indicate that vesical calculi constituted the most frequent cause of fistula formation in the bladder group (39.3 per cent), while carcinoma ranked second with 30 per cent. Vesical diverticula were found in 24.2 per cent of the cases.

An analysis of the inflammatory intestinal group showed diverticulitis to have been the primary cause in 65.8 per cent, tuberculosis was found in 17.8 per cent and appendicitis was present fourteen times (9.5 per cent) (Higgins). In Kellogg's series appendicitis was present in only 4 per cent of cases, while the incidence of

appendicitis in Balch's group was 25 per cent.

In Higgins' series the most frequent neoplastic lesion of the bowel was carcinoma of the rectum (50.8 per cent), as compared with 11.8 per cent in Balch's group. Carcinoma of the sigmoid was present in 45.9 per cent of the cases in Higgins' collection.

As regards the location of the fistula, the rectum and bladder were involved in 43.5 per cent (Higgins); 47.4 per cent (Balch); and in only 16 per cent (Kellogg). A fistulous communication between bladder and sigmoid was present in 23.8 per cent (Higgins), 26.3 per cent (Balch) and 63 per cent (Kellogg). The incidence of ileovesical fistula was 4.1 per cent (Higgins), 15.7 per cent (Balch) and 4 per cent (Kellogg). A communication between the bladder and the appendix was found fifteen times (3.4 per cent) in Higgins' series; twice (10.6 per cent) by Balch and in 4 per cent of the cases collected by Kellogg. Higgins noted eighty-two instances of vesicocolonic fistulas in a total of 441 collected cases (18.6 per cent).

SYMPTOMS

Actual Fistulas. The passage of gas or stool through the urethra constitutes unequivocal evidence of a vesico-intestinal fistula. Although the passage of urine from the rectum is also pathognomonic of this condition, this finding is not as readily ascertained as the former. It is, of course, obvious that collateral symptoms are present which in turn depend upon the segment of bowel with which the bladder communicates. If the initial lesion happens to be a carcinoma of the rectum which has subsequently broken into the bladder, the presenting symptoms will be those characteristic of rectal carcinoma, namely, constipation alternating with diarrhea, blood and mucus in stools and loss of weight. The same holds true when the initial lesion is diverticulitis of the sigmoid, in which event the outstanding symptoms are pain in the left lower quadrant of the abdomen, with blood, pus and mucus in the stool. Symptoms referable to the bladder depend upon the degree of involvement present. With the actual passage of intestinal contents into the vesical lumen, acute cystitis invariably ensues, with urinary frequency, dysuria and urgency as outstanding symptoms. The urine contains blood, pus and intestinal contents. While the passage of gas in the urine is extremely suggestive of a vesico-intestinal communication, it is occasionally found in diabetic patients with infected urines. Should an ascending infection occur, the picture is that of an acute pyelonephritis with chills, fever and lumbar pain. When the lesion is primarily in the bladder, vesical symptoms naturally predominate, and in fact will most frequently completely mask the intestinal symptoms. Diarrhea with or without tenesmus is not an uncommon symptom, particularly when an ample flow of urine into the bowel is present.

Incipient (Threatened) Fistulas. In the event the bladder is the primary seat of the lesion, it is extremely difficult to outline a syndrome which is at all suggestive of a threatened communication with an adjacent segment of bowel, since the bladder lesion must be extensive before it can lead to a vesico-intestinal fistula. Well defined urological symptoms are present long before threatening perforation occurs, so that from the urological standpoint, one can hardly suspect a threatened break-through to be detectable by changes in the genitourinary symptoms. Suspicion might be directed to this possibility, however, by the sudden onset of intestinal symptoms in a patient suffering from a serious vesical lesion.

When the lesion originates in a segment of bowel, an incipient or threatened breakthrough can and should be recognized promptly, since by so doing serious consequences may be averted. Given a patient with carcinoma of the rectum, or diverticulitis of the sigmoid, or terminal ileitis, who suddenly develops acute urological symp-

toms, it is encumbent upon the surgeon to seek an explanation for such symptoms. Symptoms may be extremely mild, such as slight increased frequency of urination or mild burning on urination; or the only suggestion of a urinary abnormality may be a varying degree of pyuria which may be constant or intermittent.

DIAGNOSIS

Actual Fistulas. In cases of well defined fistulas, the diagnosis can readily be established when patients pass urine in the stool, or gas and fecal matter through the urethra. This, unfortunately, is not always the case, in which event it becomes necessary to resort to other diagnostic procedures.

Cystoscopy usually reveals a marked degree of cystitis. The site of the communication appears as an area of edema which surrounds the actual point of perforation. The latter may or may not be seen. The stool may be seen passing through the actual fistula, or lying free in the bladder.

Occasionally, one may clinch the diagnosis by filling the bladder with a solution of indigo-carmine, and watching it return through a rectal tube or proctoscope previously introduced into the rectum.

Although theoretically possible, it is extremely difficult to visualize the rectal or sigmoidal opening of the fistula through the sigmoidoscope. Instances have been reported in which the diagnosis was established by means of the barium enema.

Incipient Fistulas. The diagnosis of a threatened or incipient fistula can only be made by proper cystoscopic examinations. The earliest sign discernible by cystoscopy is a small localized area of redness somewhere on the posterior wall of the bladder, in an otherwise normal appearing viscus. At a slightly later stage, this area reveals itself as an island of bullous edema which, when the bladder is filled to capacity, may be completely or partially ironed out. Shortly before perforation occurs the lesion closely simulates a bladder tumor because of the presence of papillomatous-like excrescences in the region of the bullous edema. The vesical mucosa surrounding this lesion may, at this time, reveal a moderate degree of erythema. An important diagnostic feature at this stage is a history of intermittent clouding of the urine. Should the urine during a cystoscopy be found turbid due to pus, the ureters should invariably be catheterized. Negative urines obtained from both kidneys, microscopically and culturally, serve as confirmative evidence that the source of the pyuria is the bladder, and lends additional weight to the suspicion that the bladder lesion is due to an incipient communication with a segment of bowel.

Localizing the exact site of the fistulous opening in the bladder is of little diagnostic importance because of the extreme mobility of the small bowel, sigmoid, transverse colon and appendix, and also because of the fact that in well established cases the high grade of accompanying cystitis and reduced vesical capacity make localization difficult and inaccurate.

PROGNOSIS

Prognosis in these cases depends upon a variety of factors. The character of the primary lesion responsible for the fistula is extremely important in appraising the ultimate prognosis. If the lesion is a malignant one, the outlook is naturally poor. On the other hand, should the original lesion be inflammatory, such as an appendiceal abscess, the outlook is good. The presence or absence of genitourinary complications such as unilateral or bilateral pyelonephritis also materially influences the prognosis, and this in turn is dependent upon the duration of the disease. In cases of threatened or incipient fistulas, the prognosis, particularly the immediate prognosis, is far better than in cases of well established vesico-intestinal fistulas. Another important consideration is the age and physical status of the patient, as younger people stand surgical intervention better than older ones. The presence of cachexia is not conducive to good healing.

TREATMENT

Vesico-intestinal fistula is an outright surgical disease and treatment may be palliative or curative. Palliative treatment is indicated in hopeless cases of carcinoma of the bowel or bladder, in which event colostomy or cecostomy is the procedure of choice in diverting the fecal flow from the bladder. Palliative colostomy may also be tried in certain cases of vesico-intestinal fistula resulting from diverticulitis of the colon. In these cases the colostomy, once established, must not be closed for many months, in order to give the involved bowel full opportunity to heal spontaneously. Colostomy is also indicated in hopeless cases of carcinoma of the bladder associated with vesico-intestinal fistula.

Curative treatment will, of necessity, depend upon the underlying pathological condition. In cases of threatened perforation, it is our opinion that preliminary colostomy is not necessary, but that one can, after proper preparation of the patient, perform laparotomy and direct appropriate treatment to the underlying lesion. By proper preparation of the patient, we mean at least four to six days of treatment with the patient in a hospital. He is given a high caloric, low residue diet containing high vitamins and minerals, and thorough cleansing of the bowel by daily use of saline catharsis. At least 2,000 cc. of 5 per cent glucose in normal saline is administered daily by slow intravenous drip, and 4 Gm. of sulfaguanidine given by mouth every eight hours, or sulfadiazine in 15 gr. doses at four hour intervals. At least one transfusion of 500 cc. of citrated blood is given before operation and another transfusion immediately after operation. In cases of carcinoma or diverticulitis of the sigmoid, the affected segment of bowel is carefully dissected away from the bladder wall to which it is more or less firmly adherent, by blunt finger dissection, and whenever possible a multiplestage Mikulicz procedure is carried out. When the lesion is due to carcinoma of the rectum one may, after carefully dissecting the bowel away from the bladder, carry out a Miles abdominoperineal resection in one or two stages, depending upon the patient's physical condition. The Mummary operation is also an excellent procedure in poor risks. When the attachment between the bladder and rectum is due to inflammatory adhesions, the bladder need not be disturbed. In cases in which the vesical wall is invaded by carcinoma, a segment of bladder can be removed along with the tumor and the bladder reconstructed over a large suprapubic drainage tube.

In cases of threatened vesico-intestinal fistulas caused by appendiceal abscesses, the abscesses should be drained and the appendiceal stumps removed whenever possible. In cases of terminal ileitis, immediate transverse ileocolostomy is carried out, after completely transecting the ileum at a sufficient distance from the inflamed segment of bowel in order to make certain that the anastomosis is performed upon healthy intestine. If it is deemed safe to complete the operation in one stage, the segment of ileum attached to the bladder is carefully dissected away from the bladder and removed along with the cecum and ascending colon. Should a two-stage procedure be considered advisable, the segment of ileum attached to the bladder is left undisturbed, and removed at the time of the second stage of the operation.

In the treatment of actual or true vesico-intestinal fistulas, it is our belief that a preliminary colostomy is necessary: (a) when actual stool is present in the urine; (b) when pyelonephritis is present; (c) when the basic lesion is carcinoma, either of the bladder or of the bowel; (d) when the bladder is markedly inflamed and contracted; (e) in cases of marked debility; and finally (f) in cases in which laparotomy discloses a lesion of the bowel, the identity of which is not readily discernible, or in which the bowel is so intimately adherent to the bladder that detachment is considered too hazardous. In performing such a colostomy for diversion of the fecal

stream, it is best to avoid a loop colostomy. A double barrel colostomy such as advocated by Lahey or Devine seems best suited for this purpose. When the lesion is hopelessly inoperable the colostomy becomes a permanent one.

As regards the time interval that should be permitted to elapse before attacking the lesion, it is our opinion that it is best to err on the long side rather than to operate too soon. This is particularly true when dealing with inflammatory lesions. In cases of carcinoma one can safely wait six to eight weeks.

A pertinent problem in this type of case is the method of handling the opening in the bladder wall. We believe that when the opening is small it can safely be left undisturbed, and an indwelling catheter introduced into the bladder through the urethra and left *in situ* for a week or ten days. In cases of larger openings, we have found that as a rule sutures do not hold because of the friability of the bladder wall, and we, therefore, resort to suprapubic cystotomy with adequate drainage of the cul-de-sac of Douglas to provide for any possible leakage.

We have found the local use of crystalline sulfanilamide of inestimable value in handling such fistulas. We do not hesitate using 12 Gm. of the drug in the cul-de-sac after detaching the bowel from the bladder wall. Following operation patients are routinely given 15 gr. of sulfadiazine at four hour intervals for at least four to five days.

Since, in most instances, the vesical capacity is markedly reduced in cases of actual vesico-intestinal fistulas, we consider it advantageous to dilate the bladder with hydraulic pressure within five to six weeks after the wound has healed. This procedure must be cautiously carried out to avoid throwing too much strain upon the weakened bladder wall.

CASE REPORTS

Case 1. Mr. S. F., aged sixty-one, first seen January 10, 1939, complained of prostatism and bilateral lumbar pain of two years' duration. Fifteen years previously he passed several calculi. There were no gastrointestinal symptoms. Following a complete study of the genitourinary tract, the diagnosis made was benign hypertrophy of the prostate. A two-stage suprapubic prostatectomy was performed and he was discharged from the hospital after twenty-one days.

About twenty-one months later transurethral revision of the bladder neck was performed for a small recurrent adenoma of the right lobe of the prostate. He left the hospital symptom-free seven days later. On January 31, 1942, approximately three months after the revision, he returned complaining of increased urinary frequency and pyuria. At that time cystoscopy disclosed an edematous circular lesion with a central umbilication situated on the posterior surface of the bladder just above the interureteric ridge. Our impression at the time of this examination was that we were dealing with an extravesical lesion which was threatening to penetrate into the lumen of the bladder. A careful digital rectal examination was negative. Sigmoidoscopy failed to show the presence of a tumor, but revealed a slight reddening and edema of the rectal mucosa. Barium enema *x*-ray and fluoroscopy showed the sigmoid flexure drawn over toward the cecum, but failed to reveal a defect. His weight was 177 pounds.

When seen ten days later he stated that although he noticed no urinary discomfort, the urine appeared very turbid at times, and at other times it was comparatively clear. Cystoscopy disclosed the same polypoid lesion seen at the previous cystoscopy. Although resembling a bladder tumor, the lesion was considered entirely inflammatory. Overdistending the bladder failed to completely iron out the lesion. The urine contained much pus. Two weeks later hydraulic distention of the bladder through the cystoscope showed that the lesion could be ironed out when the bladder was fully distended, leaving behind a slight nodular thickening of the mucosa at the site of the lesion. Both kidneys were catheterized and the specimens were found negative microscopically and culturally. At this time he was carefully questioned as to whether he had passed any feces or gas in the urine, but he did not recall such an occurrence. One week later he returned complaining of vesical irritability. A punch biopsy was performed and the tissue

report was "edematous, chronically inflamed bladder wall." Rectal examination was entirely negative, and there were no symptoms referable to the gastrointestinal tract. It appeared to us then that we were dealing with a threatened vesico-intestinal fistula and laparotomy was advised and accepted. He entered the hospital March 29, 1942, for preoperative preparation which consisted of thorough cleansing of the bowel, low residue, high vitamin diet and sulfaguanidine 4 Gm. every eight hours. The day prior to operation he was given 500 cc. of citrated blood.

Operation. (J. A. L.) On April 2, 1942, under spinal anesthesia the abdomen was opened through a long left paramedian suprapubic incision extending from the symphysis to a point just above the level of the umbilicus. There was a large infiltrating mass about the size of an adult's fist situated deep in the pelvis, intimately adherent to the posterior wall of the bladder. The mass consisted of the lower sigmoid flexure directly above the rectosigmoidal juncture. The liver and para-aortic lymph-nodes were not involved.

With the patient in high Trendelenburg position the intestines were carefully walled off with hot pads, and by careful digital manipulation the sigmoid was easily dissected away from the posterior wall of the bladder. Although the vesical wall was indurated, no opening could be visualized. There was no evidence of free pus during this procedure. Owing to the low position of the tumor it was necessary to divide the peritoneal reflexion on both sides of the mesentery as well as the peritoneal reflexion over the bladder in order to obtain sufficient mobility of the involved segment to perform a Mickulicz operation. The loop bearing the tumor was then easily delivered from the abdomen, and after uniting both limbs and closing the layers of the abdominal wall snugly around the exteriorated loop, the tumor was removed between clamps. The proximal and distal clamps were left *in situ*, thereby completely obstructing the bowel. Three Gm. of sulfanilamide powder were placed into the pelvis and around the wound. No attempt was made to reinforce the portion of the bladder wall freed from the tumor, but an indwelling urethral catheter was introduced and left *in situ* for seven days. The patient is making an uneventful convalescence and is awaiting the crushing of the spur.

Pathological diagnosis of the extirpated segment of bowel was "infiltrating adenocarcinoma of rectum with extension into adjacent fat tissue."

Comment. This is an example of a case of threatened vesico-intestinal fistula caused by carcinoma of the rectosigmoid, in which the cardinal symptoms were entirely vesical, namely, intermittent pyuria with attacks of vesical irritability. Cystoscopically, there was a polypoid edematous lesion on the posterior vesical wall simulating a bladder tumor, which at first could be almost completely ironed out by hydraulic distention of the bladder, but later could not be obliterated. Although no distinct communication between the bowel and bladder was found, it was difficult to explain the intermittent attacks of pyuria without assuming the presence of some, possibly minute, sinus between the two viscera, not large enough to permit the passage of gas or stool, but capable of transmitting bacteria. A tentative diagnosis of a threatened vesico-intestinal fistula was made prior to surgery. This enabled us to institute proper preoperative preparations. It is our opinion that such preparation was greatly responsible for the patient's smooth postoperative convalescence.

Case II. R. C., male, aged twenty-four, first seen December 16, 1940, complained of hematuria and right renal colic, dysuria and increased urinary frequency of two weeks' duration. His past history was essentially unimportant, save for an appendectomy performed in 1937.

Cystoscopy revealed a lesion the size of a fifty-cent piece occupying the right posterior wall of the bladder, which had the appearance of an irregular tumefaction with a central umbilication, attached to the bladder by a broad base. There was no inflammatory reaction of the vesical mucosa surrounding the base of the lesion. The question that arose was whether we were dealing with an infiltrating bladder tumor or with a threatened vesico-intestinal fistula. Both kidneys were easily catheterized, and the specimens from both sides showed an occasional leucocyte. Urinal-

ysis: specific gravity 1.025; albumin 1 plus; sugar negative; micro-mass of white blood cells. The bladder specimen showed Gram-negative bacilli on smear and Bacillus coli aerogenes on culture. The renal specimens were negative on smear and sterile on culture. All specimens were negative for the mycobacterium tuberculosis.

Blood Chemistry: urea nitrogen 11.5 mg. per cent; creatinin 1.07 mg. per cent; urea clearance 127.5 per cent. The genitourinary tract failed to show any abnormality on the flat and pyelographic *x*-rays.

The following day biopsy was performed upon the vesical lesion. This was reported inflammatory with no evidence of malignancy.

Physical examination was essentially negative, except for a large, boggy prostate which was felt per rectum.

Preoperative Diagnosis: Threatened vesico-intestinal fistula. The patient was sent to the hospital and thoroughly prepared for 6 days prior to operation.

Operation. (J. A. L.) On January 9, 1941, under spinal anesthesia the abdomen was opened through a six-inch midsuprapubic incision. Starting at approximately six inches from the ileocecal valve, the terminal ileum was intimately adherent to the posterior wall of the bladder. At this point the ileum was angulated and the proximal limb of this loop, which was adherent to the bladder, was dilated. The wall of this portion of ileum was very friable. The proximal limb of the loop was mobilized at a distance of about twelve inches from its attachment to the bladder and divided between crushing clamps, along with its mesentery. Both ends of the severed intestine were inverted with three layers of sutures. The proximal segment was then anastamosed side-to-side with the midportion of the transverse colon. The wound was closed in layers.

On January 27, 1941, eighteen days after the ileocolostomy, he was given 500 cc. of citrated blood and the following day, under spinal anesthesia the abdomen was opened through a long right rectus incision extending from the level of the costal arch to the symphysis. There were dense adhesions binding the terminal ileum to the posterior bladder wall. After carefully separating this loop of intestine from the bladder by blunt dissection, a small perforation was seen in the center of an area of indurated vesical wall. The affected terminal segment of ileum, ascending and proximal part of the transverse colon were resected *en masse*, and the end of the colon inverted with three layers of sutures. Raw surfaces were obliterated by suturing the cut edges of the posterior parietal peritoneum. A small Penrose drain was introduced into the retroperitoneal space and permitted to emerge from the upper angle of the wound. An attempt to close the fistulous opening into the bladder was unsuccessful due to induration and friability of the tissue. A rubber dam was introduced into the pelvis behind the bladder and permitted to emerge from the lower angle of the wound. The wound was closed in layers around drains. An indwelling urethral catheter was introduced and left *in situ* for seven days.

Following a completely uneventful recovery, he was discharged from the hospital February 12, 1941. When last seen September 18, 1941, he was completely symptom-free and had gained fifteen pounds in weight.

Comment. This is a case of threatened vesico-intestinal fistula due to terminal ileitis, in which the diagnosis was made prior to operation by cystoscopic examination. The symptoms were entirely urological. Complete recovery followed a two-stage resection and transverse ileocolostomy. The opening in the bladder could not be closed by suture, but healed spontaneously with the aid of an indwelling urethral catheter.

Case III. G. W., male, aged forty, first seen November 1, 1932, complained of severe lower abdominal pain, with complete obstipation of two days' duration. Urinary symptoms consisted of slight dysuria and increased urinary frequency. Preoperative diagnosis: Intestinal obstruction.

Laparotomy performed on November 1, 1932, revealed a large carcinoma involving the sigmoid, which was intimately adherent to the posterior vesical wall. The terminal four inches of ileum were also glued to the bladder wall. A transverse colostomy was performed. Death followed one week later, apparently from severe hemorrhage in the abdominal wound.

Autopsy showed no abnormality of the stomach and small intestine. A colostomy opening was present in the transverse colon.

The lower bowel presented many adhesions and the sigmoid was densely adherent to the bladder. There was a ragged, necrotic, annular, infiltrating tumor in the sigmoid, which had invaded the pelvic fascia and had perforated into the vesical lumen.

Microscopic examination of the sigmoidal lesion showed a papillary tumor forming irregular acini. There was great variation in the size and shape of the cells. The stroma was moderate in amount. Microscopic examination disclosed the bladder wall thickened and diffusely infiltrated with tumor cells of sigmoidal origin. The vesical mucosa in the region of the fistula was markedly hyperplastic.

Comment. This patient presented himself with symptoms of acute intestinal obstruction due to carcinoma of the sigmoid. The urological symptoms were mild, consisting of slight dysuria and increased urinary frequency. There was no evidence of stool or of the passage of gas through the urethra. Yet at operation it was noted that the tumor of the sigmoid was intimately adherent to the bladder. At autopsy an actual fistula between the sigmoid and bladder was found.

Case IV. J. L., male, aged forty-three, a resident of Honduras, Central America, first seen July 10, 1940, complained of passing stool and gas through the urethra. Illness began six years previously with difficulty in voiding and the passage of stool in the urine. Since then he had had intermittent bouts of chills and fever. He voided frequently day and night, had dysuria, and passed ribbon-like stools. His appetite was poor and bowels costive. There was a loss of fifteen pounds in weight during the past six months. The patient admitted that he had contracted syphilis twenty-five years previously and gonorrhea eighteen years ago.

Cystoscopy. A No. 21 F. cystoscope was passed with difficulty due to an obstruction at the vesical neck. The bladder capacity was very much reduced and there was a marked degree of cystitis. There was a large tumefaction involving the posterior wall of the bladder, extending into the vesical lumen. A well defined median bar was also present. Biopsy of the posterior vesical wall was reported "bladder epithelium showing extensive acute and chronic inflammation."

X-ray of the Genitourinary Tract. The right renal silhouette was much enlarged while the left appeared normal. Intravenous pyelography disclosed delayed filling of a large right hydronephrotic kidney. The left renal pelvis showed no abnormality. Cystogram showed a filling defect involving the vault and right half of the bladder.

Barium enema showed a small amount of barium filling the ampulla and rectosigmoid. The barium appeared to pass over to the right side of the pelvis, where it seemed to fray out and blend into the adjacent tissue.

Sigmoidoscopy disclosed a markedly thickened and edematous rectal mucosa but no evidence of tumor.

Physical examination was essentially negative.

Laboratory Findings. Urinalysis: specific gravity 1.012; albumin 2 plus; sugar negative; microscopy—pus and bacteria. Blood chemistry: urea n. 12.5 mg. per cent; creatinin 1.0 mg. per cent; urea clearance 136 per cent. Bacteriology: bladder urine showed Staphylococcus albus on culture. Blood count: hemoglobin 11.1 Gm. per 100 cc. of blood; red blood cells 3,225,000; white blood cells 8,250 per cu. mm.; color index 1.2. Differential: polymorphonuclear cells 66 per cent; lymphocytes 11 per cent; rods 19 per cent; mononuclears 4 per cent. Wassermann was 2 plus. 2 hour phenolsulphonphthalein 30 per cent.

Preoperative Diagnosis. Actual vesico-intestinal fistula, possibly due to carcinoma of sigmoid, with right infected hydronephrosis.

Operation I. (J. A. L.) On July 20, 1940, under spinal anesthesia the abdomen was opened through a six-inch left reversed Kammerer incision. Situated in the pelvis was a large mass consisting of rectosigmoid intimately adherent to the bladder. Although a specimen for biopsy could not be obtained, it was believed that the lesion was inflammatory rather then neoplastic. A tranverse colostomy was performed.

Operation II. (J. A. L.) On August 6, 1940, owing to the patient's marked intolerance to an indwelling urethral catheter and to the severe grade of cystitis present, a suprapubic cystotomy was performed. Upon opening the bladder a small polypoid lesion was noted on the posterior wall of the bladder. In the center

of this lesion there was a small opening through which a ribbon of pus could be seen escaping into the bladder cavity.

Operation III. (J. A. L.) On August 23, 1940, under spinal anesthesia a right nephrectomy and subtotal ureterectomy was performed for infected hydronephrosis.

He was discharged from the hospital on September 23, 1940, and returned to Honduras with a well regulated functioning colostomy. He returned to New York City on April 25, 1941, and was admitted to the hospital in preparation for a segmental resection of the sigmoid.

Operation IV. (J. A. L.) On May 6, 1941, with the patient in high Trendelenburg position, the abdomen was opened through a ten-inch right reverse Kammerer incision extending from the symphysis to a point two inches above the umbilicus. The sigmoid flexure was found indurated and adherent to the posterior wall of the bladder. By gentle finger dissection the sigmoid was carefully peeled away from the bladder. A segmental resection of the involved portion of the sigmoid was then performed, and an end-to-end anastomosis accomplished. No effort was made to close the defect in the bladder wall because of the indurated state of the tissues around the fistula. An indwelling urethral catheter was introduced. Sulfanilamide crystals were placed into the pelvis and appropriate drainage instituted. Following the operation he was given 500 cc. of citrated blood. Following an uneventful convalescence he was prepared for closure of the colostomy which was performed on June 13, 1941. He was discharged from the hospital symptom-free and all wounds healed on July 5, 1941.

Comment. We have here discussed a case of actual vesico-intestinal fistula resulting from diverticulitis of the sigmoid, complicated by a severe infection of one kidney. The stages employed in handling such a problem have been carefully reviewed. No attempt was made to close the vesical opening, which healed spontaneously with the aid of an indwelling urethral catheter. It is our impression that the use of sulfonamides both orally and locally played an extremely important rôle in the smoothness of the postoperative convalescence following the segmental resection of the involved sigmoidal segment of colon.

Case v. S. R., male, aged sixty-four, was admitted to the hospital on the night of April 28, 1941, with an acute attack of urinary retention of twenty-four hours' duration. During the past few months he had been complaining of increased diurnal and nocturnal urinary frequency. On careful questioning he admitted a loss of twenty-five pounds in weight during the past year. Two weeks previously he began having nausea and vomited on a few occasions, and also complained of alternating bouts of diarrhea and constipation.

Physical examination disclosed an emaciated, cachectic looking individual who appeared in great distress. Rectal examination failed to disclose a lesion within the lower bowel. The prostate felt neither hard nor enlarged, but a boggy fullness could be made out in the cul-de-sac. On abdominal palpation an indefinite mass was felt in the region of the left iliac fossa. The rest of the examination was essentially unimportant.

Cystoscopy revealed a well defined median bar and moderate contracture of the vesical neck. There was no evidence of lateral lobe enlargement. Situated on the posterior wall of the bladder near the vault was an area of redness and edema suggesting the possibility that this portion of the bladder was in contact with some affected intra-abdominal viscus.

Sigmoidoscopy. Situated four and a half inches from the anus and involving the anterior wall of the rectum there was an ulcerating carcinoma which, on biopsy, proved to be adenocarcinoma.

Operation. (J. A. L.) On May 13, 1941, under spinal anesthesia the abdomen was opened through a long left rectus incision, extending from the symphysis to the level of the umbilicus. Situated in the pelvis there was a large indurated mass about the size of an orange, consisting of rectosigmoid hopelessly adherent to the posterior wall of the bladder, and a loop of ileum. The entire mass was also adherent to the anterior parietal peritoneum. A permanent colostomy was performed, using the sigmoidal loop.

Following the operation all urinary symptoms promptly disappeared, and the patient lived in relative comfort for seven months before he succumbed.

Comment. This illustrates another case of incipient vesico-intestinal fistula due to carcinoma of the rectosigmoid, giving rise to symptoms of prostatism and complete urinary retention. Owing to the marked discrepancy between the urinary symptoms and the cystoscopic findings, and also because of the presence of a characteristic area of edema and congestion on the posterior vesical wall, a tentative diagnosis of an intra-abdominal lesion secondarily affecting the bladder was made. This was confirmed at operation. Complete diversion of the fecal flow from the affected segment of bowel by permanent colostomy led to prompt abatement of urinary symptoms, indicating thereby the fact that irritation of a portion of the detrusor muscle by an extravesical lesion can and does give rise to symptoms of prostatism indistinguishable from a similar syndrome caused by a lesion of the prostate gland. The differential diagnosis can only be made by careful cystoscopic interpretation.

SUMMARY AND CONCLUSIONS

1. Vesico-intestinal fistulas may be divided into actual fistulas and incipient or threatened fistulas.

2. Careful analysis of the literature indicates that inflammatory lesions of the bowel constitute the underlying cause of fistulas in the majority of cases (51 per cent). Tumors of the bowel were present in 21.3 per cent of the collected cases. A review of the inflammatory intestinal group shows that diverticulitis was the primary cause in 65.8 per cent of the cases. The most frequent neoplastic lesion of the bowel was carcinoma of the rectum (50.8 per cent). As regards the location of the fistula, it was noted that the most frequent site was between the bladder and rectum (43.5 per cent).

3. The cardinal symptoms of actual fistula are the passage of gas or stool through the urethra. Symptoms of an incipient or threatened fistula are more suggestive than pathognomonic. In cases in which the primary lesion is in the bladder, the appearance of intestinal symptoms is suggestive of a contact inflammation between the bladder and intestine. When the primary lesion is in the bowel, the appearance of vesical symptoms should likewise suggest this same condition.

4. Diagnosis, especially in cases of incipient fistulas, depends primarily upon cystoscopic examination.

5. Proper preoperative preparation of the bowel is probably one of the most important requirements for successful surgery in this type of case. In cases of actual fistulas, graded stage operations are necessary. The use of an indwelling urethral catheter obviates the necessity of closing the fistulous opening in the bladder. The systemic and local employment of sulfonamides has been found of great value in this group of cases.

6. Prognosis depends entirely upon the underlying pathological condition.

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ABSCESSES ABOUT THE ANORECTUM

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ABSCESSES about the anorectum are among the more frequent conditions seen in medical practice. It is surprising, therefore, that there should exist such a confusion concerning the diagnosis, prognosis and proper treatment of these lesions.

ANATOMY AND CLASSIFICATION

The key to the understanding and successful treatment of anorectal abscesses lies in a knowledge of the anatomy. Infections occur in well recognized locations and mainly in pre-existing potential spaces. For this reason, a brief review of the essential anatomy is in order.

The levator ani muscle is the dividing line between the deep and superficial structures of the region; it arises from the lateral pelvic wall, coursing medially and inferiorly to insert into the midportion of the anal canal between the internal and external sphincters. (Fig. 1.) Below this muscle, on each side of the anus, is an ischiorectal space, bounded by the obturator internus laterally, the skin and subcutaneous tissues inferiorly and the fascia lining the undersurface of the levator superiorly and medially. The ischiorectal space is, then, roughly pyramidal in shape, and filled with an elastic pad of fat.

Above the levator, there is a potential space between the superior fascial covering of the muscle and the lowermost reflection of the peritoneum. This space is limited posterolaterally on each side by the lateral ligaments of the rectum, in which course the middle hemorrhoidal vessels, and is called the pelvirectal space. Between the two lateral ligaments posteriorly, that is, between the rectum anteriorly and the sacrum posteriorly, is the postrectal or retrorectal space.

Abscesses may be classified according to their location as follows:

1. *Deep* (above the levator)
   - *a.* Submucous (in the rectal wall)
   - *b.* Pelvirectal (in the superior pelvirectal space)
   - *c.* Retrorectal (in the postrectal space)
2. *Superficial* (below the levator)
   - *a.* Intracutaneous
   - *b.* Subcutaneous
   - *c.* Ischiorectal

ETIOLOGY AND PATHOGENESIS

The sequence of events in nearly all of the more common abscesses, is quite uniform. At the anorectal line, which is located 1½ to 2 inches from the anal verge, is a series of small pockets, circularly disposed, and called crypts of Morgagni. These pockets are normally only 1 to 2 mm. in depth. They open upward toward the rectum, and are equipped in their recesses with the so-called anal glands, which are branching, racemose structures leading deep into the surrounding muscles. It frequently happens that a particularly hard stool, or a seed or other foreign body, will tear or scratch one of the crypts during defecation. This leaves a portal of entry for the numerous bacteria which are always present and a cryptitis ensues. The anal glands at the fundus of the crypt help carry the infection deeper into the perianal tissues. If the invasion of these tissues progresses beyond this point, a variety of paths may be taken. The most common is a direct extension through the substance of the external sphincter into the ischio-

rectal space, where the loose fat breaks down and an ischiorectal abscess develops.

If, on the other hand, the infection from the crypt burrows through into the pelvirectal space, a pelvirectal abscess is found.

This is the pathogenesis of all but the most unusual ischiorectal abscesses and explains why a fistula develops following the incision and drainage of the abscess. The fistula is, in fact, merely the contracted wall of the old abscess cavity. Submucous abscesses are caused by a scratch on the surface of the mucous membrane, admitting bacteria which multiply and produce an infection of the submucosa between the rectal mucous membrane and the circular muscle layer.

Inflammatory processes in the various pelvic structures (seminal vesicles, prostate, etc.) may produce pelvirectal abscesses.

A retrorectal abscess may either proceed from a crypt in the usual manner, or may result from infection of the glands of Gerota, a small group of lymph-nodes located in the postrectal space and draining the rectum. When the infection proceeds through the lymph channels to these glands without making a direct fistulous tract, there may be no macroscopic connection with the rectum, and it is possible for the abscess to be drained without leaving a fistula-in-ano. Intracutaneous and subcutaneous abscesses of the perianal region develop from infections through the skin as in other parts of the body and do not produce fistulas. (Fig. 2.)

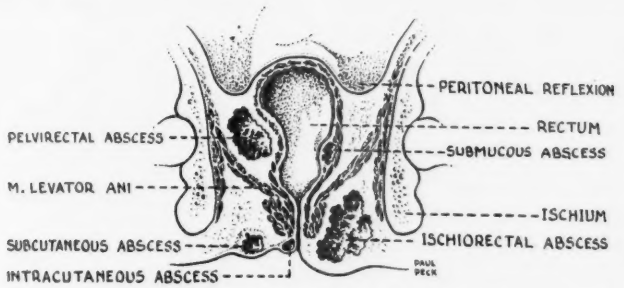

Fig. 1. Section through the pelvis showing location of abscesses mentioned in the text.

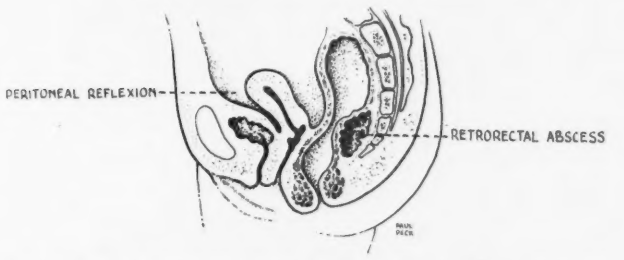

Fig. 2. Sagittal section through the pelvis, showing location of a retrorectal abscess.

SYMPTOMS AND DIAGNOSIS

Superficial abscesses are noted by the patient as a swelling beside the anus, growing progressively larger and more painful. The tenderness, especially in the latter stages, is exquisite, and pain precludes the possibility of sleep. Constitutional reactions are present in the form of fever and malaise. Deep abscesses are more gradual in their onset and do not produce such prompt and obvious signs of inflammation. The patient is prone to complain of a heavy feeling and a dull ache deep in the pelvis, lower part of the back, or even down the thighs. Constitutionally, however, the disturbance may be severe.

Diagnosis is usually simple. Inspection and palpation will reveal the classical signs of inflammation in the ischiorectal cases. When seen early, a finger inserted into the anal canal will produce sharp

pain which will be localized by the patient on one side or the other. With an anoscope in position, the surgeon can, by exploring the crypts, arrive at a diagnosis. Often pus will be seen exuding from the offending crypt. At this stage, the differential diagnosis will be between early abscess and fissure-in-ano; the latter, however, is easily revealed by inspection. If symptoms are present suggesting an abscess in the anorectal region, but no external signs are noted, a finger inserted into the rectum will usually demonstrate a tender, boggy swelling behind or to one side of the rectum, causing the rectal wall to bulge into the lumen. If this bulge is lateral, a pelvirectal abscess is diagnosed, and if posterior, a retrorectal. The point of greatest tenderness in a retrorectal abscess is usually in the midline between coccyx and anus. It is obvious, considering the anatomy (Fig. 1), that a swelling felt by the finger in the rectum must be above the levator.

It frequently happens that an abscess may perforate the levator from the ischiorectal space to the pelvirectal or vice versa.

PROGNOSIS

Fistula-in-ano is to be expected following an abscess about the anorectum. Although cases undoubtedly exist of ischiorectal abscesses which, being drained, heal and do not result in fistulas, such instances are much rarer than was formerly believed. Since nearly all of these abscesses start as an infection in a crypt, they become fistulas as soon as they are drained externally either spontaneously or by surgical means. Although complete healing may temporarily occur, sooner or later there will be found a draining sinus which connects with a diseased crypt at the anorectal line. Most fistulas are obvious at once, but occasionally as long as two to five years may elapse between the original incision of the abscess and the development of a fistula. It is in this type of case that an inadequate follow-up gives basis for the illusion that an abscess has been present and has not been followed by a fistula.

Except in known tuberculous patients, the incidence of tuberculosis in these cases will not be over 2 to 5 per cent. There is no sound basis for the ordinary belief that fistula-in-ano (and by implication the abscess preceding the fistula) is of tuberculous origin in most instances.

TREATMENT

The treatment of any anorectal abscess is wide incision and drainage. No temporizing measure has enough value to be recommended. In cases of ischiorectal abscess, it is wise to open and drain well while the infection is small, and even before the tissues have broken down to form pus and produce fluctuation. Nothing is gained by waiting, except to prolong the discomfort and enlarge the scope of the inevitable operation and the size of its subsequent fistula.

INCISION AND DRAINAGE OF SUBMUCOUS ABSCESS

Through a suitable speculum, the patient being in the prone position with hips elevated, an incision is made over the point of fluctuation and in the longitudinal axis of the bowel. No anesthesia is necessary unless the abscess is quite near the anorectal line, when 5 cc. of 1 per cent novocaine injected into the external sphincter will be found sufficient for analgesia. Less bleeding will be encountered if the incision is performed with the actual cautery or the endotherm. The incision is made for the entire length of the abscess, leaving no pockets at either end. Under no circumstance is a transverse incision to be made. A ½ inch wide gauze strip soaked in dichloramine-T, or a small Penrose drain, may be inserted into the cavity and removed in twenty-four hours. Mineral oil ½ to 1 ounce may be given nightly by mouth. The daily application of a 1 per cent aqueous solution of gentian violet to the wound under direct vision through a proctoscope, will aid in healing.

INCISION AND DRAINAGE OF PELVIRECTAL ABSCESS

The patient is placed in an exaggerated lithotomy position, under general, low spinal, or sacrocaudal anesthesia. An incision is then made with the scalpel, anteroposteriorly, and at least 1 inch from the anal verge, so as to avoid severing any fibers of the external sphincter. If pus is encountered in the ischiorectal space the incision is enlarged as described for ischiorectal abscess. An index finger is then inserted into the rectum, and with the other hand a closed Kelly hemostat is pushed against the inferior surface of the levator ani. Although this muscle, with its covering fascia, is ordinarily rather tough, nevertheless when an abscess is present above the levator, it will be comparatively easy to thrust the closed hemostat through it. While this is being done, the finger in the rectum is used as a guide to prevent the clamp from perforating the bowel. When the abscess is entered, the closed blades of the clamp are opened and the instrument withdrawn. The opening in the levator is then enlarged in the direction of its fibers, and a piece of vaseline gauze introduced into the depth of the wound. An area of skin is excised from the lateral edge of the skin incision in order to provide free drainage; dressings are applied.

Immediately following the return of sensation, the wound area is continuously covered with hot, wet saline dressings. The vaseline gauze drain is removed in twenty-four to forty-eight hours, and the wound is opened daily to its furthermost depths with the gloved finger or a glass rod dipped in 1 per cent gentian violet. This is a much less painful maneuver than packing and unpacking with iodoform gauze. The bowels are permitted to move when they will. If no movement has taken place by the third day, a mild laxative or a low saline enema is administered. The patient is allowed out of bed about the third day; after this time the wet dressings are discontinued and hot sitz baths substituted. A sitz bath is ordered following each bowel movement and three times a day. Each bath lasts for ten minutes and is as hot as can comfortably be borne (105 to 110°F.). The patient is usually discharged on the fourth or fifth day and dressed daily in the office thereafter.

INCISION AND DRAINAGE OF RETRORECTAL ABSCESS

The patient is anesthetized and placed in an exaggerated lithotomy position. An incision is made in an anteroposterior direction behind the anus and about one inch to one side of the midline. If desired, the incision may be made directly in the midline, but in this case it is necessary to injure the anococcygeal ligament. The dissection is continued by the method of thrusting ahead a closed hemostat and opening it, or by blunt dissection with the gloved finger, proceeding always posteriorly and toward the midline in the direction of the retrorectal space. When the abscess cavity is reached and the pus is discharged, the opening is enlarged so as to give adequate drainage, the lateral edges of the skin wound are excised to prevent premature healing, and a strip of vaseline gauze or a Penrose drain is inserted. Dressings are then applied.

The after-care is the same as for pelvirectal abscess (vide supra).

INCISION AND DRAINAGE OF INTRACUTANEOUS AND SUBCUTANEOUS ABSCESSES

In the anorectal region, these abscesses, which are not primary at the anorectal line, are rare, and usually small. For drainage, cruciate incision is made and the four quadrants of skin thus formed are trimmed away, thus uncapping the entire abscess cavity. Vaseline gauze is applied. The wound is then dressed daily and will be found to heal readily by granulation from the bottom.

INCISION AND DRAINAGE OF ISCHIORECTAL ABSCESS

The patient is anesthetized, (using a general, low spinal, or sacrocaudal anesthesia), and is placed in an exaggerated lithotomy position. By palpation, the point of maximum fluctuation is determined. An incision is then made into the fluctuating area as near to the anus as possible, but at least 1½ inches from the anal verge, in order to avoid injury to the external sphincter fibers. The incision is made in a vertical direction, and should be about 2 inches long. After the skin has been cut, a closed hemostat is plunged through the subcutaneous tissue into the abscess cavity, opened and withdrawn. The finger is now inserted and the cavity explored. With the knowledge thus gained, the incision is lengthened anteriorly or posteriorly or both, sufficiently far so that the entire extent of the abscess is opened. All loculi within the cavity are broken down with the finger, taking care not to use so much force that normal tissues are invaded. The *lateral* edge of the skin wound is now excised as far as is necessary to remove the roof of the cavity. If the abscess is large enough, this maneuver will practically uncap the whole ischiorectal fossa. The resulting wound should gape widely at the skin level and grow progressively smaller toward the depths of the wound, thus permitting free drainage. Vaseline gauze is lightly laid into the wound and gauze dressings applied.

The postoperative care is the same as that laid down for pelvirectal abscess.

Comment. The question often arises as to whether an attempt should be made at the time of operation upon the abscess, to locate and remove the internal opening in the crypt, thus curing the fistula before it develops. It is the opinion of the author that in the very occasional instance of a small abscess, superficial to the sphincter, near the anus and with an obvious internal opening, such may be done. In the great majority of cases, however, it is far better to drain the abscess and leave the fistula until later. By so doing, several dangers and difficulties are avoided: The danger implicit in opening clean areas in the presence of virulent pus, the difficulty of working accurately in an anatomy distorted by swelling and edema, the danger of tearing due to friability of the tissues and the danger of severing the sphincter muscle before it has a firm attachment of scar tissue. Generally speaking, a period of six to twelve weeks should elapse between drainage of the abscess and fistulectomy.

SUMMARY

1. Anorectal abscesses are classified according to their anatomical location, and the relevant anatomy is described.

2. The pathogenesis of anorectal abscesses is given.

3. Diagnosis and prognosis are discussed, and the probability of fistula following anorectal abscess explained.

4. Operative treatment for each of the various types is described in detail.

SYMPTOMATIC PILONIDAL CYST

OPERATIVE TREATMENT

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SYMPTOMATIC pilonidal cysts are cause for frequent admissions on the surgical service in the Station Hospital, Camp Polk, Louisiana. Their appearance is explained by the fact that our soliders for the most part fall within what is known as the "pilonidal age group." They are male adults usually between twenty and thirty years of age and are daily participating in strenuous army activity. During the past twelve months fifty such patients have been operated upon and the pathological condition has varied from a single draining sinus to a previously operated cyst with sinuses. (Figs. 1 and 2.)

TREATMENT

We believe that symptomatic pilonidal cysts should be treated surgically with excision of the pathological condition. The resulting wound heals either by primary intention, granulation followed by epithelization, or a combination of the two, depending upon the manner in which the patient is treated. In our series all types of closure have been used. Excision of the cyst has been followed by (1) no closure, (2) partial closure, or (3) complete closure.

Surgical measures are important in the treatment of the pilonidal cyst but should follow an adequate preoperative preparation. The soldier that presents himself with a pilonidal abscess or a grossly infected draining sinus is not ready for excision of his cyst until all gross evidence of infection has been removed. All cases are put on hot saline sitz baths for fifteen to twenty minutes two to three times daily. The patients are observed daily to make sure that there is always adequate drainage. If an abscess is present, incision and drainage is indicated and then the sitz baths are started. After all purulent drainage and tissue induration has disappeared, surgical excision of the pilonidal cyst is in order. It probably would be advisable to delay the surgery two or three months but this has not proved practical in the army. The patients who have been returned to duty at the time their infection cleared up with instructions to return later for surgery, have usually had another flare-up of their cysts and we have seen them in the same condition as on previous admission, or they are transferred to another camp where the condition becomes symptomatic before they again reach a hospital.

At the beginning of the pilonidal series in this hospital, the general tendency was to leave excised pilonidal wounds open and allow healing to take place by granulation and epithelization. However, a few wounds were partially closed. Neither of these methods gave results that we thought were satisfactory, so the practice of complete closure of the wound was started. With the latter, our results were greatly improved and for the past four months this has been the procedure followed, with one exception. In this one case it was necessary to excise most of the sacrococcygeal ligaments which would have prevented complete closure without leaving undesirable dead space. In this same case there was much wound contamination because the cyst was ruptured during the excision.

Our patient with a pilonidal cyst receives a saline enema the night preceding and the morning of operation. One to two hours before coming to surgery, the patient's sacrococcygeal region is shaved, scrubbed

with green soap and water, painted with tincture of merthiolate and covered with a sterile towel. Preoperative medication consists of morphine sulfate given hypodermically and barbiturates in some form orally. The anesthetic drug generally used is 120 mg. of spinal procaine. For operation the patient is placed on the table in a prone position and after lowering the lower half of the table about 10 degrees, 3 inch lateral traction adhesive straps are applied to each buttock and fastened beneath the table. This makes the skin tense thereby aiding in minimizing the width of the excision wound and helping to prevent undermining of the skin. The operative site is further prepared with applications of ether and tincture of merthiolate. The pilonidal cyst is distended under moderate pressure with a sterile solution of 1 per cent methylene blue solution with the amount used depending upon the size of the cyst. A 2 cc. syringe is used to which is attached the hub portion of a hypodermic needle. The methylene blue solution furnishes an excellent guide to follow in excising the cyst. The excision of the desired area is performed by making a more or less vertical elliptical excision which is usually extended down to the sacrococcygeal ligaments. Great care is taken not to cut into the cyst and thereby contaminate the field. To remove all pathological disorders it is not infrequent that portions of the ligaments have to be excised. There have been no removals of the coccyx. Hemostasis is obtained by using hot saline packs and ties of plain No. 0 catgut or cotton No. 60. At this point the lateral traction adhesive is removed from the buttocks.

Fig. 1. Typical pilonidal sinus (Case No. 41 in series).

Fig. 2. Pilonidal cyst following incision and drainage (Case No. 35 in series).

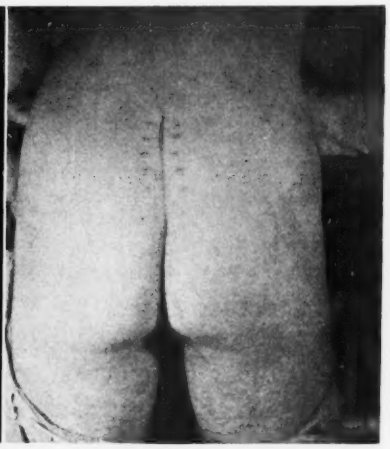

Fig. 3. One hundred per cent healing by primary intention of completely closed pilonidal wound (Case No. 37 in series).

With primary wound closure being the desired procedure three to five transverse retention sutures of black silk No. 8 are placed beneath the sacrococcygeal ligaments. Another check is made to see that all hemorrhage is controlled as blood oozing would predispose to a wound breakdown. Sulfanilamide powder is sifted into the wound and into each layer of the closure. A total of 5 to 8 Gm. of the drug is generally used. A row of interrupted chromic No. 1 catgut or cotton No. 20 sutures are placed in the lower portion of the wound again passing beneath the sacrococcygeal ligaments. We wish to emphasize that these sutures are placed below these ligaments to eliminate dead space. The subcutaneous tissues are closed with interrupted plain No. 0 catgut or cotton No. 30 and the skin edges are approximated with end on mattress sutures of black silk No. 1. The retention sutures are tied over a 3 to 5 inch rolled dry sponge which covers the closed wound. Further

CASE HISTORIES

No.	Date Admitted	Age	Duration since Symptoms First Noticed	Admission Pathology	Incision and Drainage	Preoperative Time	Type Wound Closure	Post Operative Time	Total* Hospital Days	Comments
1	6/17/41	26	2 years	Draining sinus.	No	6 days	Partial	37 days	43 days	Complete healing.
2	6/24/41	23	3 years	Draining sinuses.	No	2 days	Open	66 days	68 days	Complete healing.
3	6/27/41	23		Draining sinuses.	No	11 days	Open	75 days	86 days	Complete healing.
4	6/30/41	26	2 mos.	Draining sinuses.	No	8 days	Partial	185 days	193 days	Before complete healing obtained scar tissue excised and wound grafted.
5	9/11/41	19	4 days	Draining sinus.	Yes	18 days	Partial	42 days	60 days	Complete healing.
6	9/30/41	23	2 weeks	Draining sinuses.	No	7 days	Partial	68 days	75 days	Non-healing wound curetted before complete healing obtained.
7	10/3/41	25	2 years	Draining sinuses.	No	6 days	Open	38 days	44 days	Complete healing.
8	10/23/41	21	8 mos.	Draining sinuses.	Yes	4 days	Open	46 days	50 days	Complete healing.
9	10/23/41	26	6 mos.	Abscess.	Yes	7 days	Open	153 days	160 days	Before complete healing obtained scar tissue twice excised.
10	11/19/41	22	2 weeks	Abscess.	Yes	6 days	Open	57 days	63 days	Returned two weeks following discharge with ulcer at site of healed wound. Discharged 11 days later healed.
11	12/19/41	28		Abscess.	Yes	11 days	Open	58 days	69 days	Complete healing.
12	1/5/42	25		Draining sinus.	No	1 day	Complete	20 days	21 days	100% primary intention. Incision and drainage 3 weeks prior to admission. Returned for excision.
13	1/26/42	22	2 years	Draining sinus.	No	1 day	Complete	12 days	13 days	100% primary intention.
14	2/6/42	31	3 years	Draining sinus.	No	10 days	Complete	36 days	46 days	98% primary intention.
15	2/9/42	23	2 mos.	Cellulitis.	No	8 days	Complete	64 days	72 days	50% primary intention.
16	2/15/42	22	3 mos.	Draining sinuses.	Yes	32 days	Complete	64 days	96 days	80% primary intention
17	2/25/42	22		Draining sinus with previously excision scar wound.	No	13 days	Open	43 days	56 days	Complete healing. Previous operation Sept. 1941 at another Army Camp.
18	3/3/42	25	3 days	Draining sinus.	No	14 days	Complete	15 days	29 days	100% primary intention.
19	3/9/42	23	7 days	Draining sinus.	No	7 days	Complete	19 days	26 days	100% primary intention.
20	3/9/42	22	3 mos.	Abscess.	Yes	15 days	Complete	14 days	29 days	100% primary intention.
21	3/11/42	25	4 days	Draining sinus.	No	8 days	Complete	15 days	23 days	100% primary intention.
22	3/13/42	22	1 week	Abscess.	Yes	10 days	Complete	12 days	22 days	100% primary intention.
23	3/21/42	23	2 years	Abscess.	Yes	23 days	Complete	74 days	97 days	50% primary intention.
24	3/23/42	32	5 days	Abscess.	Yes	28 days	Complete	24 days	52 days	100% primary intention.
25	3/24/42	26	3 weeks	Cellutitis.	No	9 days	Complete	64 days	73 days	100% primary intention. Healed completely in 28 days post operatively, but had skin slough at spinal site which necessitated the stay.
26	3/25/42	24	2 weeks	Draining sinus.	No	8 days	Complete	64 days	72 days	60% primary intention.
27	3/27/42	20	2 years	Draining sinus.	No	7 days	Complete	44 days	51 days	98% primary intention.
28	3/31/42	22	8 years	Abscess.	Yes	23 days	Complete	†	†	0% primary intention. ½" superficial granulating wound remains.
29	4/3/42	24	7 days	Draining sinus.	No	20 days	Complete	39 days	59 days	75% primary intention.
30	4/9/42	30	1½ years	Draining sinus.	No	1 day	Complete	16 days	17 days	100% primary intention. Sitz baths advised 1 week prior to hospitalization.
31	4/10/42	28		Draining sinus.	Yes	3 days	Complete	30 days	33 days	75% primary intention.
32	4/27/42	23	3 weeks	Abscess.	Yes	17 days	Complete	46 days	63 days	75% primary intention.
33	4/27/42	23	3 days	Abscess.	Yes	14 days	Complete	24 days	38 days	100% primary intention.

CASE HISTORIES (*Continued*)

No.	Date Admitted	Age	Duration since Symptoms First Noticed	Admission Pathology	Incision and Drainage	Preoperative Time	Type Wound Closure	Post Operative Time	Total* Hospital Days	Comments
34	4/27/42	25	1 year	Draining sinus.	Yes	14 days	Complete	†	†	80% primary intention. ½" superficial granulating wound remains.
35	5/1/42	35	2 years	Draining sinus.	Yes	31 days	Complete	†	†	100% primary intention. 20 days postoperative.
36	5/2/42	26	5 years	Draining sinuses.	No	4 days	Complete	19 days	23 days	100% primary intention. History of at least 15 incision and drainages in the past.
37	5/7/42	24	1 year	Draining sinus.	No	11 days	Complete	†	†	100% primary intention. Very large closure wound See figure.
38	5/13/42	33	2 years	Draining sinus.	No	7 days	Complete	18 days	25 days	100% primary intention.
39	5/20/42	22	2 years	Draining sinus.	No	21 days	Complete	†	†	100% primary intention. 20 days postoperative.
40	5/27/42	26	4 mos.	Abscess.	Yes	22 days	Complete	†	†	100% primary intention. 12 days postoperative.
41	5/29/42	22	3 years	Abscess.	Yes	15 days	Complete	†	†	75% primary intention.
42	6/2/42	27	3 weeks	Abscess.	Yes	8 days	Complete	†	†	100% primary intention. 20 days postoperative.
43	6/2/42	25	3 days	Draining sinus.	No	9 days	Complete	†	†	100% primary intention. 19 days postoperative.
44	6/4/42	24	2 years	Draining sinus.	No	7 days	Complete	†	†	75% primary intention.
45	6/8/42	25	2 days	Abscess.	Yes	10 days	Complete	†	†	100% primary intention. 12 days postoperative
46	6/9/42	34	3 days	Draining sinus	No	6 days	Complete	†	†	100% primary intention. 15 days postoperative.
47	6/10/42	33	2 days	Draining sinus.	No	5 days	Complete	†	†	100% primary intention. 15 days post-operative.
48	6/13/42	31	1 mo.	Abscess.	Yes	9 days	Complete	†	†	100% primary intention. 8 days post-operative.
49	6/18/42	20	1 year	Draining sinus.	No	4 days	Open	†	†	Cyst ruptured into during operation so closure not thought advisable.
50	6/18/42	25	5 mos.	Draining sinus.	No	4 days	Complete	†	†	100% primary intention. 8 days post-operative.

1. Average pilonidal cyst age—25 years.
2. Average time symptomatic pathology present—1 year
3. 50% of the cases had had disturbances prior to army service
4. Average pre-operative treatment time—10 days.
5. Average total hospitalization with no closure of wound—74 days (8 completed cases).
6. Average total hospitalization with partial closure of wound—93 days (4 completed cases).
7. Average total hospitalization with complete closure of wound—45 days (22 completed cases).
8. 64.8% of the cases with complete closure obtained 100% primary intention.

* Patient hospitalized until condition permits return to army duty.

† Denotes patient still in hospital.

dry dressings are applied and the buttocks are firmly strapped together.

Postoperative treatment consists of the foot of the bed elevated for six hours to prevent postspinal headache, liquid diet for five days, and absolute bed rest with frequent change of position for ten to twelve days plus usual symptomatic measures. Bowel movements are discouraged and generally are not a disturbing factor. A saline enema is given on the sixth postoperative day. This is the first day the dressing is changed following operation and the time when the skin sutures are removed. The retention sutures are left in place eight to ten days if possible. The patient usually walks freely about the ward on the twelfth to fourteenth day. One case (a nurse) has, however, been discharged to duty as early as the twelfth day. (Fig. 3.)

A precautionary measure taken at the time of discharge from the hospital is to request the soldier's Commanding Officer to give him duty for two weeks where motorcycle driving, truck driving and excessive walking can be avoided. This is not an unusual request, for following any

type of surgery a soldier should be allowed time to again adjust himself to life in the field. There have been no cases to return with recurrent cysts in this series. One patient was placed on guard duty immediately following hospitalization and there was a slight breakdown of his previously healed wound. We believe that excessive walking was the causative factor. After eleven days of additional hospitalization, the soldier was discharged to duty as cured. (Table 1.)

SUMMARY

1. A series of fifty operations on symptomatic pilonidal cysts is reported.

2. Preoperative care of the pilonidal cysts to minimize infection is accomplished by repeated hot sitz baths.

3. Our operative method of choice is excision followed by complete wound closure.

4. To minimize the width of excision wounds and aid in preventing undermining of the skin, lateral traction of the buttocks is maintained during operation.

5. Complete hemostasis of excised pilonidal wounds is obtained before a closure is made.

6. Dead space is eliminated in the closure by placing deep sutures and retention sutures beneath the sacrococcygeal ligaments.

7. Infection of the closed pilonidal wound is usually prevented by sifting powdered sulfanilamide throughout the wound closure.

THE SUSPENSORY MUSCLE OF THE DUODENUM

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THE primary purpose of this study has been to determine the manner of attachment of the suspensory muscle, or ligament, of the duodenum and to attempt to deduce the probable effect of this attachment and the contraction of the muscle upon the size of the angle at the duodenojejunal flexure. Incidentally, we have attempted to determine if there is a considerable percentage of cases in which muscle fibers can be demonstrated in this structure.

Some clinicians have contended that this structure is attached directly to the flexure and as a result of this attachment, the size of the angle at the flexure is decreased during contraction of the muscle and movement of the gut, with consequent tendency toward causing partial obstruction at this point.

ANATOMY OF STRUCTURES INVOLVED

The duodenum consists of the first ten inches of the small intestine and is held against the posterior abdominal wall, largely behind the peritoneum, in such a manner as to describe a C-shaped curve with the distal end of the "C" turning sharply forward and downward to form the duodenojejunal flexure. For descriptive purposes it is usually divided into four parts. The first part about two inches in length, begins at the pyloric end of the stomach at the level of the first lumbar vertebra and extends to the right and slightly backward to the neck of the gallbladder where it turns rather sharply downward to become the second part. The second part, about three inches in length, runs downward to the level of the third lumbar vertebra, where it bends abruptly

FIG. 1. Suspensory muscle of duodenum in position in an adult. A, suspensory muscle of duodenum; B, duodenojejunal flexure.

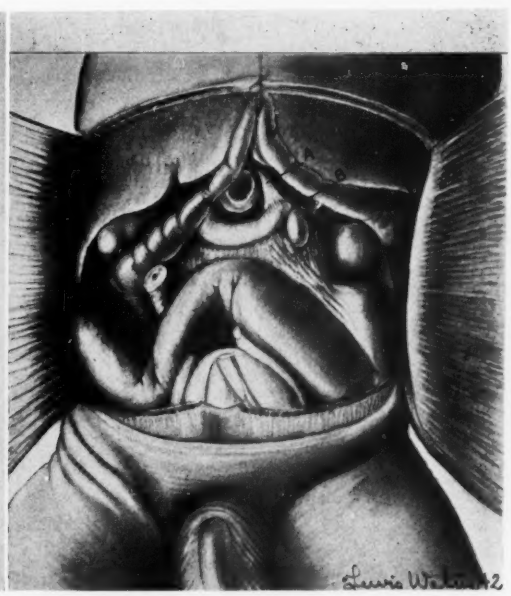

FIG. 2. Suspensory muscle of duodenum in position in a newborn infant. A, suspensory muscle of duodenum; B, duodenojejunal flexure.

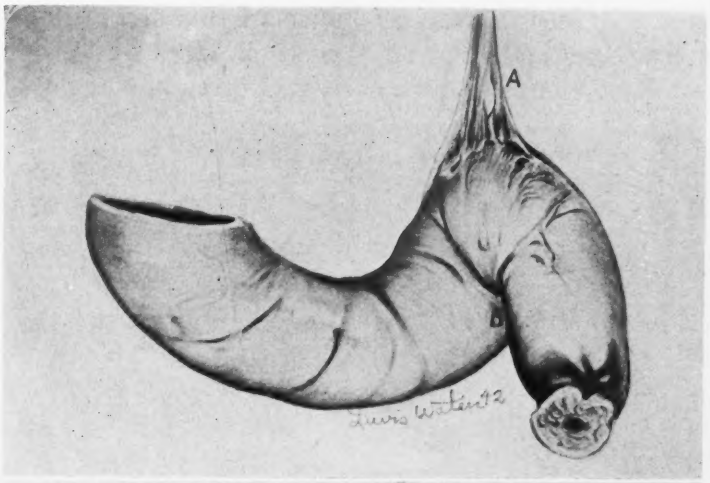

Fig. 3.

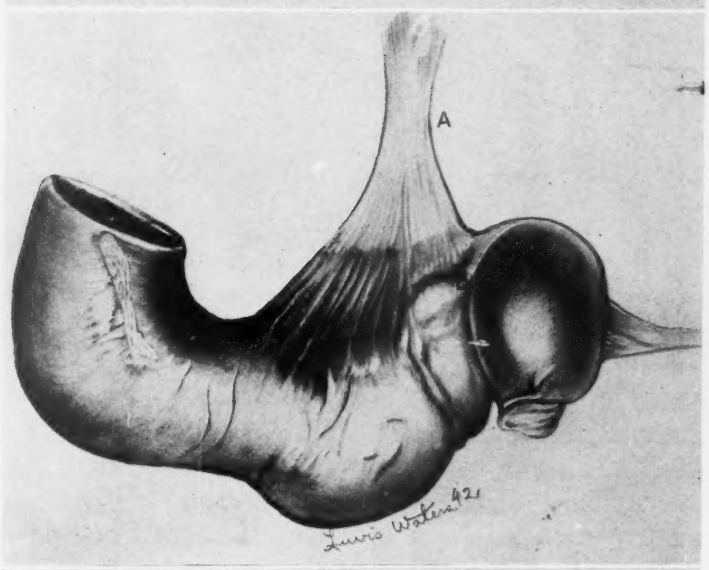

Fig. 4.

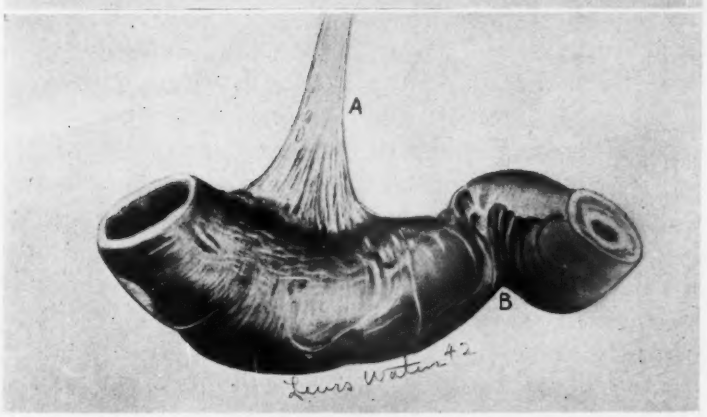

Fig. 5.

Fig. 3. Suspensory muscle of duodenum after removal from the body. A, suspensory muscle inserted solely into the duodenojejunal flexure, B.

Fig. 4. Suspensory muscle of duodenum after removal from the body. A, suspensory muscle inserted into the duodenojejunal flexure, B, and into the fourth and third parts of the duodenum.

Fig. 5. Suspensory muscle of duodenum after removal from the body. A, suspensory muscle inserted into fourth and third parts of the duodenum with no attachment to the duodenojejunal flexure, B.

to the left to become the third part. The third part, nearly four inches in length, runs almost horizontally to the left, with a slight inclination upward, to a point just to the left of the median plane, where it turns upward to become the fourth part. The fourth part, a little more than an inch in length, runs upward to the level of the second lumbar vertebra, where it turns sharply forward and downward as the duodenojejunal flexure.

The suspensory muscle of the duodenum takes origin from the right crus of the diaphragm and from the dense fibrous tissue around the celiac artery. From this origin it extends downward behind the pancreas, the splenic vein, and in front of the left renal vein to be inserted into the duodenum. The location of this insertion is the chief object of this study.

PROCEDURE

Gross Study. We dissected this structure in seventy-seven cadavers, thoroughly cleaning it from its origin to its insertion, noting carefully its precise attachment to the gut, and also noting presence or absence of muscle fibers as could be detected grossly. Figure 1 shows the gross appearance of this structure in an adult left in position after dissection. Figure 2 shows it similarly in a newborn child. Figures 3, 4 and 5 show it after its removal from the body.

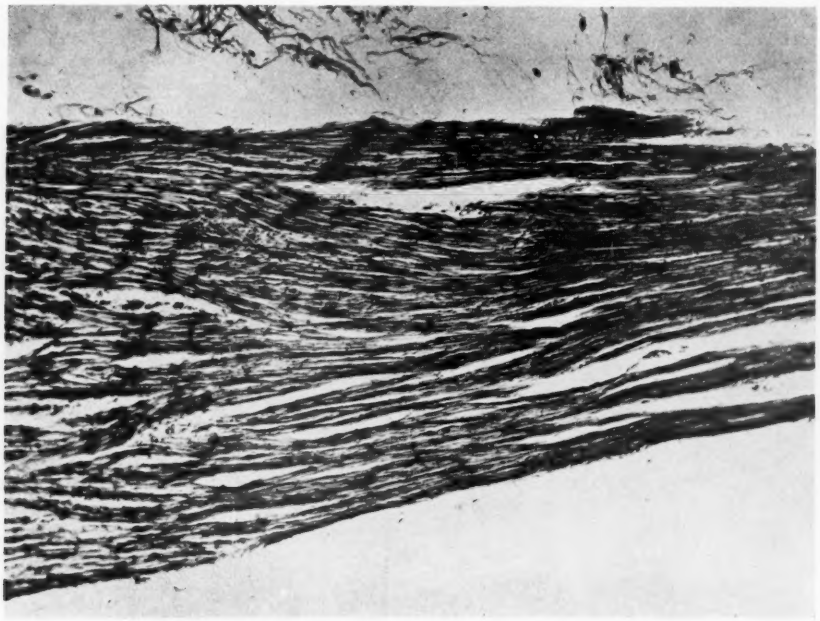

Fig. 6. Microphotograph showing section of suspensory muscle of duodenum as seen under low magnification.

Microscopic Study. We took sections from forty specimens, without any attempt at selection, to be examined microscopically for presence or absence of muscle fibers. Twenty of these were taken from the group in which muscle fibers could be demonstrated grossly, and twenty from the group in which muscle fibers could not be definitely identified grossly. Figure 6 shows a photomicrograph of one of these sections under low magnification and Figure 7 shows a photomicrograph of one under high magnification.

RESULTS

Gross Findings. In four (5.2 per cent) of our specimens the fibers of the suspensory muscle were attached solely to the flexure, no fibers being attached to the fourth and third parts of the duodenum; in forty-seven (61 per cent), the fibers were attached to the flexure and to the fourth and third parts of the duodenum; and in twelve (15.6 per cent) the fibers

were attached solely to the fourth and third parts of the duodenum, no fibers being attached to the flexure.

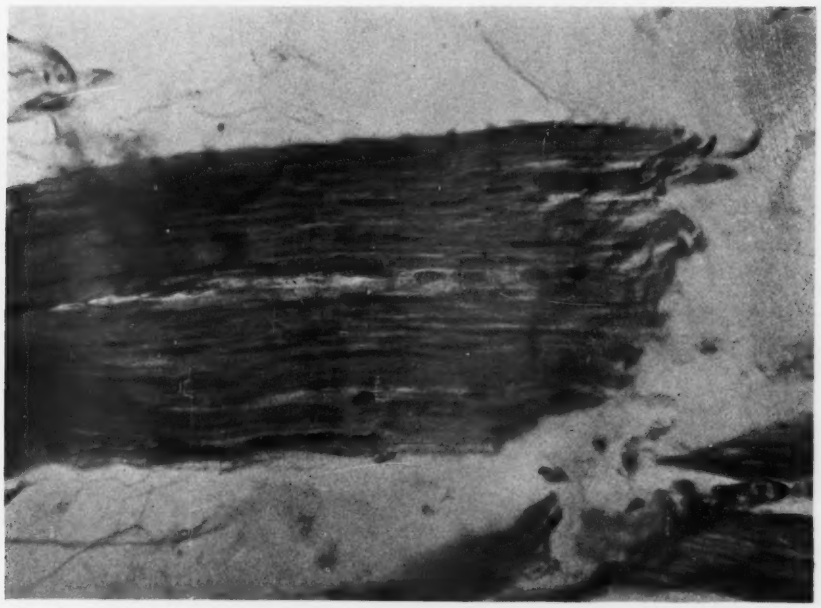

Fig. 7. Microphotograph showing section of suspensory muscle of duodenum as seen under high magnification.

In fourteen (18.2 per cent) of our specimens neither muscle nor ligament could be demonstrated, the fibers apparently having blended with the surrounding fibrous tissue.

In twenty-four (31.2 per cent) of our specimens there appeared, from gross examination, to be muscle fibers present; and in thirty-nine (50.6 per cent) one could not determine, from gross examination, whether or not muscle fibers were present.

Microscopic Findings. In eighteen of the sections taken from the twenty cases in which muscle fibers could be demonstrated grossly, muscle fibers could be demonstrated microscopically; and in sixteen of the sections taken from the twenty cases in which muscle fibers could not be definitely identified grossly, muscle fibers could be demonstrated microscopically.

DISCUSSION

By referring to Figure 3, one can see that in the four cases (5.2 per cent) in which the muscle or ligament was attached solely to the flexure there might be a tendency to reduce the size of the angle at the flexure upon movement of the gut or contraction of the suspensory muscle, thus causing a partial obstruction at this point. But by referring to Figures 4 and 5, it will be seen that in the fifty-nine cases (76.6 per cent) in which this structure is attached to the fourth and third parts of the duodenum, there would seem to be a tendency to prevent any change in the size of the angle at the flexure and thus to aid in prevention of constriction of the gut at this point.

Since there is such a scarcity of reports in the literature on this structure, there seems to have been very little investigation of it recently. The textbooks in gross anatomy apparently convey the idea that in adults there are rarely to be found any muscle fibers in it. But it will be noted that in our series there were muscle fibers present in thirty-four of the forty specimens examined microscopically. All of these cases were adults and probably all of them were over thirty years of age.

In the description of this muscle in Morris' Human Anatomy[4] it is hinted that there might be a few skeletal muscle fibers present, these being derived from the crus of the diaphragm. All other authors are noncommittal on this point. We made a

particular study of this and found only nonstriated muscle fibers present.

Although we have been unable to find any reports of a study of the nerve supply of this muscle, it might be assumed that since its muscle fibers are similar to that of the gut, its nerve supply would be the same as that of the gut. If this be true, its contraction might be synchronous with the peristaltic movements of the duodenum. In view of the manner of insertion of the muscle into the duodenum, as found in most of our cases (76.6 per cent into the fourth and third parts of the duodenum), it would seem that its contraction has a tendency to increase the size of the angle at the flexure during movement of the duodenum, thus preventing obstruction at the flexure.

The authors wish to thank Mr. Lewis Waters, Instructor in Medical Art, Baylor University, College of Medicine, for doing the drawing and photography for us.

Acknowledgment is gratefully extended to Dr. Warren Andrew in our department for doing the histologic work.

We also wish to express our appreciation to Dr. Dorsey K. Barnes, Assistant in Orthopedic Surgery, Baylor Hospital Staff, who initiated this work and aided in the gross dissection.

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VENOGRAPHY OF LOWER EXTREMITY*

A NEW TECHNIC—PRELIMINARY REPORT

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THE film labelled "James Matthews" demonstrates a venogram of the deep vessels of a normal lower extremity. This was obtained by the method commonly in use—injection of diodrast into the small saphenous vein exposed through an incision posterior to the lateral malleolus. The film labelled "Rosie Denison" demonstrates a venogram of the great saphenous vein. This was obtained using exactly the same procedure as in the "James Matthews" case and would usually be interpreted as a blockage of the popliteo-femoral vein. The finding was very unexpected because there was no history nor signs of any vascular disturbance in the limb, and the venogram had been done to demonstrate the deep

FIG. 1. Venogram showing popliteal and femoral vein.

FIG. 2. Venogram showing great saphenous vein.

* From the Departments of Surgery and Roentgenology, Jefferson Davis Hospital, Houston, Texas.

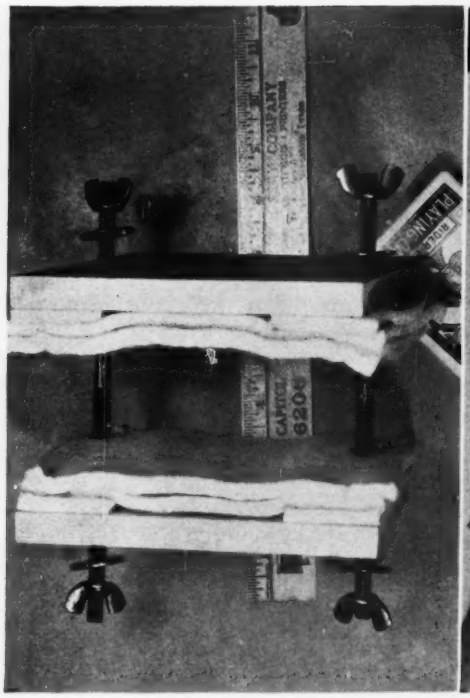

Fig. 3. Apparatus to compress great saphenous vein at knee.

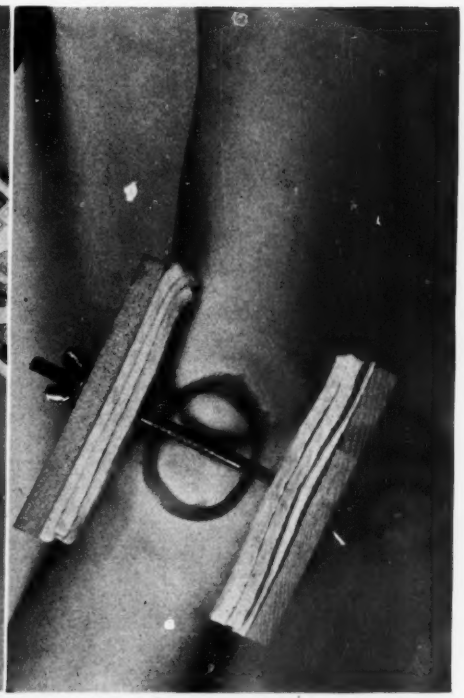

Fig. 4. Apparatus in place; patella is outlined.

Fig. 5. Venogram with apparatus in place; great saphenous vein not seen proximal to tibial condyles; popliteal vein seen fading off in proximal popliteal space.

veins of a normal lower extremity. The explanation regarded as the most likely was that in this case there was less resistance to the flow of the injected solution in the great saphenous than in the small saphenous vein causing the solution to go into the saphena magna through the communicating veins of the distal leg.

To obviate such happening when deep vein blockage is suspected and also to do away with the necessity of cutting down on the small saphenous vein, I devised the crude apparatus illustrated separately and in position at the knee. It consists of two blocks of wood, each six inches by six inches by one-half inch, well padded with felt as illustrated and connected by two iron bars eight inches in length and threaded for three inches at each end. It is slipped over the leg until the anterior bar is at the midpatella region and then tightened until the patient states it is very tight. The purpose of this is to compress the great saphenous vein at the medial side of the knee but not the small saphenous vein in the popliteal area. Such being the case, diodrast injected in any vein of the foot or ankle region should have to pass this area by going through the deep veins or the small saphenous vein. If the deep vein should be blocked due to a pathological process, a detour around the compressed area of saphena magna or a failure of the dye to go farther should be expected.

In the one case illustrated using this apparatus, the diodrast was injected into a vein on the dorsum of the first metatarsal bone. It can be seen that in the area of the knee the diodrast is in the popliteal vein, and there is none in the saphena magna. (This patient had no vascular disturbance, the diodrast being given for an intravenous urogram.) The idea of blocking the great saphenous vein in order to demonstrate the deep veins seems justified in this one case. The ease of venipuncture rather than the operative procedure and sterile set-up necessary for cutting down on the small saphenous vein also recommends a trial of the procedure to both physician and the patient. The apparatus described can probably be greatly improved as the method is put to further use.

THE USE OF SULFATHIAZOLE VASELINE OINTMENT*

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THE use of vaseline gauze strips on operative incisions, before dressings are applied, has been a tried surgical procedure. Wishing to contribute more security to the postoperative area, I have used, with success, the following plan. Two-inch gauze strips are planted in a pan of 5 per cent sulfathiazole vaseline ointment. The pan is sterilized in the autoclave for forty-five minutes at twenty pounds pressure.†

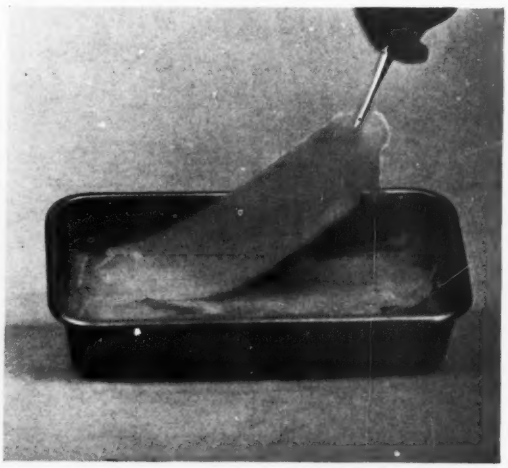

FIG. 1. Pan and 5 per cent sulfathiazole vaseline gauze.

The effect of steam sterilization on the sulfathiazole suspension was examined by placing a sample of the ointment in the sterilizer along with the impregnated gauze so that both were similarly heated. That the control sample was not in contact with the dry gauze was considered unimportant. After heating, the petrolatum of the control was dissolved in petroleum ether. The sulfathiazole was filtered on a fritted glass crucible and washed thoroughly with the same solvent.

Without further purification, the recovered sulfathiazole melted at 197–199°C. while the original material melted at 198–200°C. in comparison (both uncorrected).

Only traces of substances active in the Bratton and Marshall method of determining the sulfanilamides were extracted from the petroleum ether by alkali.

There is thus no evidence of decomposition of the sulfathiazole during sterilization.

CONCLUSIONS

1. The incision heals faster with 5 per cent sulfathiazole ointment gauze.
2. Stitch abscesses are virtually not seen after the use of this vaseline gauze.
3. Sulfathiazole ointment gauze is used successfully as packing in osteomyelitis.
4. There is no evidence of decomposition of sulfathiazole during sterilization.

* From the Allegheny General Hospital, Pittsburgh, Pennsylvania. † Dr. Taylor, of the Wm. H. Singer Memorial Laboratory, has investigated the effect of heat on the sulfathiazole radical.

Case Reports

PRIMARY CARCINOMA OF THE FALLOPIAN TUBE*

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AND

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OF 376[1] cases of primary carcinoma of the Fallopian tube reported in the world's literature[1–16] to date, we were able to find only one case which was correctly diagnosed preoperatively.[17] This striking fact emphasizes the need of reviewing the clinical features of the disease so that tubal carcinoma may be considered a diagnostic possibility. Unless we include this in our differential diagnosis, the likelihood of a correct clinical diagnosis is thereby reduced. The purpose of this paper is to emphasize the significance of the symptoms and signs of this clinical entity.

Etiological Considerations. The disease is most frequent in the climacteric years. Cases have been reported, however, as early as eighteen and as late as seventy-three years of age. Its incidence in gynecological malignancies, as reported by various observers, varies from 0.2 to 0.5 per cent. The lesion is bilateral in about one-third of the cases.[18]

Many observers believe that inflammation is a contributory factor in the etiology of tubal malignancy. We incline to the opinion that it bears no causal relation to the disease for the following reasons: (1) If inflammation were a factor, tubal cancer would be much more common. (2) Tubal cancer has been demonstrated to have been present in a large number of cases unassociated with inflammatory lesions. (Vest[19,20] in 132 cases found fifty with no accompanying inflammation.)(3) It is highly probable that in a large percentage of the cases in which inflammation was present it was the result rather than the cause.

PATHOLOGY

A review of morbid anatomical observations indicates the following to be the most probable sequence of events in the pathogenesis of the lesion. The symptoms and course of the disease depend upon which segment of the tube is initially involved. In 70 per cent of the cases the lesion appears to start at the fimbriated end. The fimbriae adhere early and a hydrosalpinx results. With increasing distention of the tube, pain ensues and peristaltic contractions result in extrusion of the tubal contents into and through the uterine cavity, producing leucorrhea. The discharge may be serosanguineous or bloody depending upon the extent of hemorrhage within. The relief of tubal distention by periodic discharge causes remission of pain, a noteworthy characteristic of this symptom. In the remaining 30 per cent, the lesion starts in the isthmus. This type of lesion carries the worst prognosis because here, too, tubal occlusion occurs early and with it there is intraperitoneal dissemination of the carcinoma. Rarely, are there tubal

* From the Brooklyn Cancer Institute.

occlusions at both ends, which would confine the lesion to the interior of the tube.

From the standpoint of morphology there are two types, papillary and infiltrating. The former grows into the lumen of the tube and metastasizes comparatively late, the latter grows into the wall of the tube, penetrates the serosa and spreads early intraperitoneally. Like other types of cancer, tubal carcinoma metastasizes by direct extension and through the lymphatics. The lymphatic pathway is usually along the upper margin of the broad and infundibulopelvic ligaments and the ovarian vessels to the iliac, aortic and lumbar nodes. It also may spread via the round ligament and produce inguinal node enlargement. The close interweaving of the lymphatics of the tube with those of the ovary and uterus may cause early extension to these structures.

Metastases in tubal cancer have been reported[21] in the cervix and fundus uteri, ovary, vagina, bladder, kidney, liver, lungs, stomach, large intestine, diaphragm, spleen, skin and supraclavicular nodes.

SYMPTOMATOLOGY

Intermittent lower abdominal pain, relieved by leucorrhea, and a receding palpable adnexal mass are the triad of symtoms that should suggest tubal cancer when making a differential diagnosis. According to Doran,[22] pain was present in 53 per cent of his cases. Since about 30 per cent of tubal carcinoma is bilateral, the pain may also be bilateral. It is cramp-like and lower abdominal in type and may be relieved by vaginal discharge which reduces tubal distention by extrusion of its contents into the uterine cavity. This type of pain with the associated periodic remission is present in lesions in which the fimbria is occluded. Lesions not situated in this area usually produce a constant dull, aching pain.

DIAGNOSIS

A review of the physical findings before operation reveals that from 70 to 85 per cent of the patients were operated upon because of the presence of a palpable mass on pelvic examination. The association of masses with inflammatory disease of the adnexae and their great preponderance as compared with neoplastic masses may exclude this disease entirely as a diagnostic possibility in the mind of the casual examiner. Many cases are overlooked even at operation and diagnosed as hydrosalpinx and simple procedures are performed. At laparotomy, every adnexal mass should be incised and examined, as an apparent hydrosalpinx may conceal within itself a tubal carcinoma and an ovarian cyst may contain an ovarian neoplasm. Frozen section may save the surgeon the embarrassment of a second laparotomy. The presence and type of symptoms depend upon the size of the lesion, pressure on adjacent structures, and the presence or absence of metastases.

At this point, it is important to include a discussion of the use of uterine curettage in the diagnosis of tubal cancer. If a patient has a sanguineous discharge with no demonstrable lesion and a careful uterine curettage reveals a normal or atrophic endometrium, this finding suggests a laparotomy to rule out a tubal cancer. If the endometrium is hyperplastic, a granulosa cell tumor of the ovary is suggested. In either case, a laparotomy is indicated if the patient is operable. The possibility of tubal or ovarian cancer should condemn the practice of radium or *x*-ray therapy for postmenopausal uterine bleeding without a preliminary curettage and other indicated diagnostic procedures.

We can summarize the avoidable errors in diagnosis as follows: (1) Do not overlook the possibility of tubal cancer in a patient with bilateral adnexal masses. Thirty per cent of all tubal cancer is bilateral. (2) Do not neglect to open a hydrosalpinx immediately after removal. The findings may demand a more radical procedure. (3) Do not be satisfied with a negative curettage in a case of unexplained postmenopausal uterine bleeding. Look further and if

necessary do a laparotomy, as you may find a tubal cancer. (4) Do not overlook constitutional factors. The patient may have a systemic cause for her bleeding.

PROGNOSIS

There is one insurmountable barrier to the early diagnosis of tubal cancer and that is the absence of symptoms in early malignancy of this organ. Of the cases reported, 99 per cent were discovered at laparotomy or at autopsy and the diagnosis was almost invariably made by the pathologist.

Reliable figures for the survival rate in this disease are lacking because of the following reasons: (1) Very few of the cases reported are adequately followed. (2) Autopsy findings are mostly of those patients that come to the clinician in the late stages of the disease so that the antecedent course cannot be accurately determined. (3) The large majority of these cases had exploratory, surgical procedures or palliative radiation therapy which makes the efficacy of treatment doubly difficult to determine.

The following figures on survival periods are given by various authors:

Wharton[23]—3 out of 14 patients were alive 3 years or more, about 21 per cent.

Wechsler[24]—6 out of 200 cases of tubal cancer survived 3 years, about 3 per cent.

Doran—10 out of 40 postoperative cases survived only 6 months

Watkins[25,26]—followed 3 cases. All died within 3 years; several others report 9 cases with survival periods of 3, 5, 8, 19 and 20 years

Graves[27]—quotes Shack and gives 2 per cent as the rate of cure

Of the 8 cases reported by Parsons[28] and well followed, 2 are alive, but treated too recently for satisfactory evaluation; one is lost and 5 are dead; three of the patients who died received *x*-ray therapy.

Kehrer[29]—in 80 cases found 5 cures, or 6.2 per cent

These figures plainly indicate a very poor prognosis. The general impression, as in most types of cancer, is that the localized and completely resectable lesion holds out good hopes of cure and that radiation therapy,[30] although not curative, may prolong life and contribute materially to the comfort of the patient. We have no grounds for drawing further conclusions.

The accepted method of treatment, therefore, is complete hysterectomy with wide excision of the adnexae and broad ligaments followed by *x*-ray therapy. Although the efficacy of *x*-ray therapy has not been proved, we believe the patient should have the benefit of the doubt.

CASE REPORTS

Case 1. L. R., a fifty-four-year old, married, white female was admitted to the Brooklyn Cancer Institute April 22, 1940, complaining of profuse leukorrhea and irregular vaginal bleeding of three months' duration. Previous menstrual history was normal. She was a gravida VII and para V. All labors were difficult; two deliveries were by means of forceps. Her general condition was good with no weight loss or other symptoms.

Vaginal examination revealed a parous introitus, scarred pelvic floor, transverse laceration of the cervix, uterus small and anterior, parametria free, and adnexae slightly thickened. There was a sanguineous leukorrheal discharge. The impression was carcinoma of the corpus uteri. Four days later, a diagnostic curettage revealed small, nontortuous uterine glands lined by low columnar nonsecretory epithelium. No evidence of malignancy was found. One week later, laparotomy showed a pseudohydrosalpinx on the left. A supracervical hysterectomy and a bilateral salpingo-oophorectomy were performed. On section, the left tube contained a large soft mass within its lumen and was closed at the isthmic and fimbriated ends.

Macroscopic examination revealed the left tube to be 8 cm. in length. The isthmic end was narrow, the fimbriated end 1 cm. in diameter and completely closed. On cut section, the wall of the distal 2 cm. was thickened and consisted of a firm, yellowish white tissue which was thrown into what appeared to be numerous large plicae. The lumen contained no fluid. The right tubal wall was thin, the fimbria patent and the lumen empty. Both ovaries

were atrophic. The uterus was small and showed no gross evidence of neoplasm.

Microscopic examination showed the section

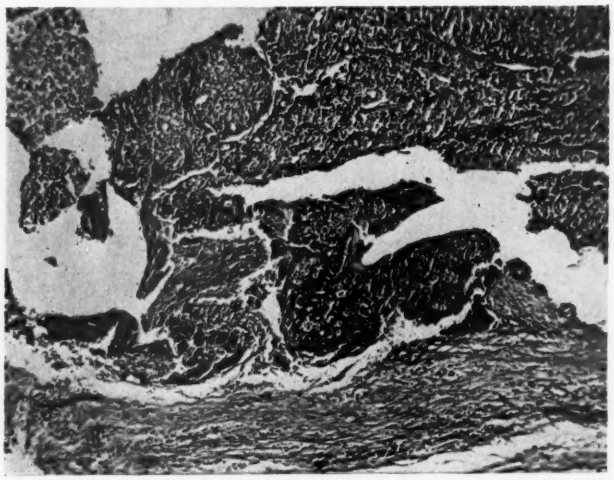

Fig. 1. Case 1. Left Fallopian tube primary anaplastic carcinoma. 50 ×.

through the mass at the fimbriated end of the left tube to consist of broad sheets of atypical cells, groups of which widely invaded all the tissues of the wall. No muscularis was recognizable, this having been replaced by dense, hyaline, poorly cellular fibrous tissue, heavily infiltrated with lymphocytes. The individual tumor cells were large, having poorly defined cell boundaries, pale pink cytoplasm, and round or ovoid vesicular nuclei with prominent nucleoli. Regular mitotic figures were common. In the uninvolved portions of the tube the plicae were broadened and interconnected to form pseudoglands. The fibrous tissue was increased and infiltrated with numerous lymphocytes, plasma cells, polymorphonuclear leukocytes and numerous hemosiderinladen phagocytes. The inflammatory infiltrate extended into the muscularis. Sections through the right tube, both ovaries and uterine wall presented no tumor either primary or metastatic. *Diagnosis:* Anaplastic carcinoma of the left Fallopian tube.

Convalescence was uneventful. Four months later, a cycle of high voltage Roentgen therapy was given prophylactically to the pelvis. January 19, 1942, twenty-one months later, the patient gained weight, had no complaints, and pelvic examination was negative for residue or recurrence.

Case II. B. H., a forty-four-year old, married negress, was admitted to the hospital, on May 20, 1940, because of a serosanguineous vaginal discharge of seven months' duration. She complained of no abdominal pain. Previous menstrual and obstetrical history was noncontributory. Her past history was irrelevant except for acute salpingitis at the age of twenty-two. Vaginal examination revealed an enlarged nodular fibroid uterus. A hysterosalpingo-oophorectomy was performed. The uterus was moderately enlarged by multinodular fibroids, undergoing hyaline degeneration. The endometrium was atrophic. A hydrosalpinx with a papillary adenocarcinoma showing degenerative and inflammatory changes was present in the left tube. Only chronic salpingitis was found in the right. Both ovaries showed vascular sclerosis and corpora albicantia but no malignancy.

Four months later she was referred to the Brooklyn Cancer Institute where a cycle of high voltage *x*-ray therapy was given. A year later she was operated upon for the removal of a cyst of Gartner's duct. On January 22, 1942, twenty months later, she was free from evidence of recurrence and had gained twenty-five pounds.

Case III. M. D., a forty-two-year old, married, white female was admitted to the hospital June 3, 1940, with a complaint of "irregular menstrual bleeding of six months' duration," and bilateral lower abdominal pain radiating to the back. Menstrual, obstetrical and past history were nonessential. Vaginal examination showed a large, fixed mass deep in the pelvis filling the hollow of the sacrum and a soft mass in the region of the left adnexa. At laparotomy, the findings were: "Uterus and

adnexa bound down by fine adhesions to pelvic peritoneum and intestine. Right tube and ovary the seat of a large cystic, adherent mass deep down in hollow of sacrum. Left tube distended, about three to four times its normal size. Fimbriated ends of both tubes closed, right tube and ovary being incorporated in one mass. Left ovary grossly normal and left in situ. The left tubovarian mass and right distended tube were excised." The diagnosis of bilateral carcinoma of the Fallopian tubes was made by the pathologist.

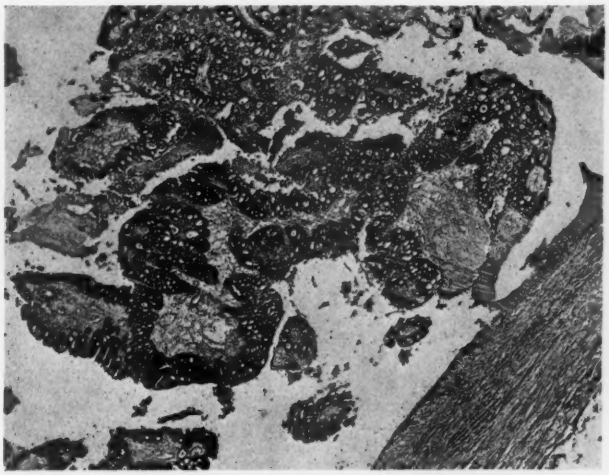

Fig. 2. Case 11. Left Fallopian tube primary papillary adenocarcinoma. 25 ×.

The report of the macroscopic examination was as follows: "The specimen consists of both tubes and the right ovary. The right tube and ovary together measure 9 by 3.5 by 2.5 cm. They are intimately bound by firm dense adhesions. The tube has a boggy consistency and on cross section is found to be filled with a pinkish, gray, succulent tissue presenting a brain tissue consistency. The fimbriated end of the tube cannot be found. The ovary is completely replaced by a sac of corrugated wall. The cyst wall measures up to 0.5 cm. in thickness. The left tube measures 6 by 2.5 by 2 cm. It is tortuous, boggy in consistency, and the fimbriated end is obliterated. The distal third of the lumen of this tube is filled with tissue similar to that in the right tube."

The microscopic examination was as follows: "Both tubes are almost completely filled with cuboidal to columnar epithelial cells arranged in placques, strands, papillary processes and acini. The nuclei show marked variation, and numerous mitotic figures. The tubal walls are invaded." *Diagnosis:* Bilateral tubal adenocarcinoma.

A month later diagnostic curettage revealed a uterus three and one-half inches deep with no malignancy. The following month she was referred to the Brooklyn Cancer Institute for *x*-ray therapy. Examination, at this time, revealed a uterus slightly enlarged and fixed in position. On its left side, there was an adherent mass three inches in diameter. A total hysterectomy and left oophorectomy were performed. Metastatic carcinoma was found in the ovary but none in the uterus.

The macroscopic examination revealed the following: The specimen consisted of uterus, with its cervix, and a separate specimen which grossly appeared to contain tubal tissue. The uterus measured about 12.5 by 7.5 by 4.5 cm. Its serosa was granular and in certain areas hemorrhagic. Its adnexae were absent. On section the uterine wall appeared to be slightly thicker than normal, and grossly appeared to contain some fibrous strands. The endometrium was slightly congested and smooth. At one cornua, a very small, pin-head sized hemorrhagic cyst was found. The cervix was moderately hypertrophied, firm, and on section disclosed several small cysts containing mucus. The small separate mass described as appearing to be tubal tissue on section appeared to have a convoluted arrangement with some thickening of what appeared to be wall of the tube. The serosal parts of the tube appeared to be adherent to each other and the overlying mucosa was granular and hemorrhagic in appearance.

Microscopic examination showed that implanted on the surface of the ovary and invading its fibrocullular stroma were masses of

tumor cells arranged as multiple small papillae. Large areas were necrotic. The individual cells were columnar or polyhedral, having indefinable cell boundaries, a pale pink cytoplasm, and varying sized, shaped, and stained vesicular or hyperchromatic nuclei which had prominent single or multiple nucleoli. There were scattered, regular mitotic figures. No tumor was present in the myometrium. The cervical lining was stratified squamous. There was a moderately heavy, subepithelial, lymphocytic infiltrate. The cervical glands were widely dilated. No tumor was present. *Diagnosis:* Metastatic papillary adenocarcinoma to left ovary.

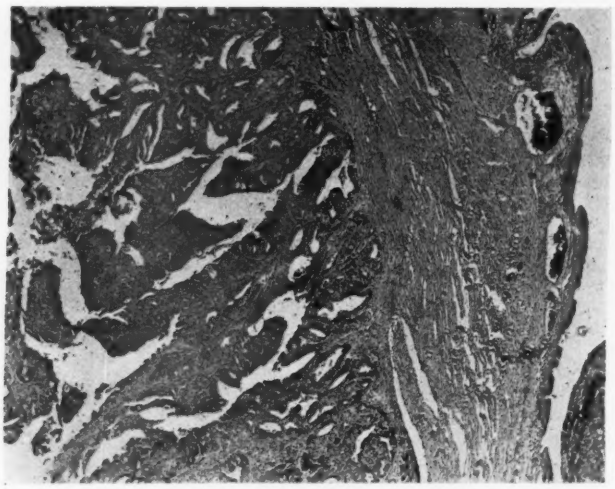

FIG. 3. Case III. Bilateral Fallopian tubes primary adenocarcinoma. 25 ×.

The immediate postoperative course was uneventful. This was followed by the usual cycle of Roentgen therapy. Eleven months later she again came under our care at which time the entire pelvis was found to be filled with a large mass extending almost to the umbilicus compressing the rectum posteriorly against the sacrum and causing symptoms of partial intestinal obstruction. Proctoscopic examination showed a normal mucous membrane and the obstructive symptoms caused by extrinsic pressure. She complained of severe pelvic pain probably because of pressure on the sacral nerves. There was also a metastatic nodule in the posterior vaginal wall. This was radiated by a vaginal radium applicator containing three capsules for a total dosage of 1200 mgh. The patient became progressively worse and died within a month, which was just over a year from her initial admission to a hospital. Necropsy permission was refused.

CASE IV. P. P., a forty-five-year old, white, married female was admitted to the hospital on December 16, 1940, with a history of vaginal spotting, bleeding, leukorrhea, and abdominal pain of one year's duration. Her menstrual and obstetrical histories were irrelevant. She had no weight loss or pain. She complained of moderate weakness. At thirty-two she had had an acute attack of salpingitis which subsided under conservative therapy. The preoperative findings were a large, palpable, abdominal mass of four months' duration. A supracervical hysterectomy and bilateral salpingo-oophorectomy were performed. The findings at operation were: "Uterus slightly enlarged and one small fibroid felt intramurally on the anterior surface. The abdomen was filled by two masses consisting of solid and cystic areas of a convoluted pattern and of a bluish discoloration, apparently, tubes and ovaries. The left ovary was discrete from the left tubal mass. The right tubo-ovarian mass extended to beneath the liver and was adherent to omentum and intestine by a few fine adhesions. The left tubal mass extended deep into the sacrum and was adherent with many fine bands. Each mass was roughly the size of two large male fists. No evidence of any peritoneal implantations." Five days later there was a disruption of the abdominal wound which required resuturing.

The macroscopic examination was reported as follows: "The uterus is small, irregular in outline due to two myomata and presents a polyp on the upper, anterior endometrium. Both tubes are tremendously elongated, distended, and twisted upon themselves. Both

ovaries are small, the left bound by dense adhesions to the tube. At the isthmic end of the left tube, a small bulbous enlargement is noted. This presents a firmer consistency than the boggy consistency noted in the remainder of the tube. Both tubes contain serohemorrhagic fluid, but in the main are filled with papillary excrescences, both discrete and confluent, especially, on the left side, measuring up to 7 cm. in diameter. Both tubes are somewhat constricted near the cornual ends. The bulbous enlargement at the cornual end of the left tube is found to be due to complete filling of the lumen by the fragile, pearly-gray, friable tissue."

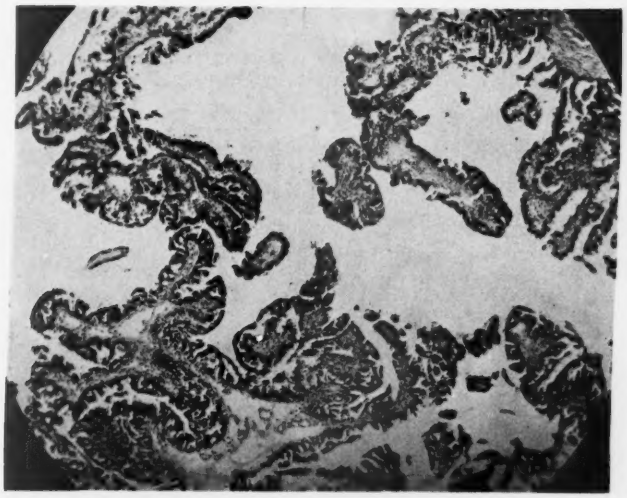

Fig. 4. Case iv. Bilateral Fallopian tubes primary papillary adenocarcinoma. 40 ×.

The microscopic examination revealed the following: "The tubal lumina are dilated and filled with masses of tumor cells arranged as multiple, papillary projections around narrow vascular cores. The cells are cuboidal to columnar and have varying sized, shaped and stained nuclei which are frequently undergoing mitotic division. There is widespread invasion of the tubal walls and myometrium by tumor cells which commonly are found in distinct lymphatic spaces. There is, also, invasion of the right tubo-ovarian ligament. The endometrial polyp is typical and benign.

Diagnosis: "Bilateral papillary adenocarcinoma of the tubes with extension to the uterus and ovaries. Fibromyomata of the uterus. Endometrial polyp."

One month after operation, she was referred to the Brooklyn Cancer Institute for Roentgen therapy. Her chief complaints were marked weakness and the loss of twenty-five pounds. Vaginal examination showed a parous introitus, cervical stump high in the vaginal vault pressed forward by an irregular mass filling the cul-de-sac. In the left vaginal wall there was a submucosal, nodular, metastatic mass. Rectal examination confirmed the vaginal findings. The usual cycle of Roentgen therapy was given without incident except for a herpes zoster and stormy menopausal symptoms. Her general and pelvic condition became progressively worse and she was transferred for custodial care four months after admission to our institution. Two months later she died and necropsy permission was refused.

Case v. E. K., a fifty-two-year old, white, virgin female was admitted to the Brooklyn Cancer Institute January 8, 1935. Her symptoms were postmenopausal bleeding and intermittent lower abdominal pain. There was a mass in the cul-de-sac, the size of an orange originating on the left side, which at laparotomy proved to be an anaplastic, cystic carcinoma of the left Fallopian tube. Both ends of the tube were closed. This case has been ably reported by Dr. Herman Charache.[31]

SUMMARY

The literature of primary tubal carcinoma is reviewed. Salient clinical aspects are presented. The clinical triad of intermittent lower abdominal pain, relief by leucorrhea, and a receding palpable adnexal mass is emphasized. Unless this clinical entity is included in the differential, it is almost invariably overlooked in the

final diagnosis. Therapy to be rational must be based upon accurate clinical diagnosis, therefore, hormonal, pharmacological, *x*-ray, or radium therapy should not be administered symptomatically. During operation all specimens should be incised and examined macroscopically to determine whether more radical procedures are indicated. The only five cases that have occurred at the Brooklyn Cancer Institute are reviewed in this paper. Interestingly enough, they have all appeared during the last six years.

CONCLUSION

Primary tubal carcinoma is insidious in onset, evasive in clinical diagnosis and extremely rare. Our threshold of suspicion to this clinical entity must be lowered if we are not to overlook this diagnostic possibility, even though it is so uncommon. Prognosis is invariably fatal, therefore, early diagnosis and immediate radical therapy must be instituted.

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ACUTE APPENDICITIS IN INFANCY

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ACUTE appendicitis in infancy is a rare condition. Furthermore, it presents a difficult diagnostic problem. It was therefore thought advisable to record an additional instance of this disorder and point out the diagnostic difficulties encountered in appendicitis of very young infants.

An examination of the literature disclosed but a single paper which included a large series of reported cases of acute appendicitis in infants. This was a publication by Abt,[1] who listed eighty infants with appendicitis in his review of the literature from 1847 to 1917. Of these eighty infants thirty-seven were one year of age or younger.

Studies by other authors have emphasized the infrequency of appendicitis in infants, particularly in the group of infants less than one year of age. For example Beekman[2] stated that of forty-three cases of this disease in children under five years the youngest was twenty months. In a report by Busch[3] on 635 cases of acute appendicitis the youngest patient was eighteen months. Of 592 children less than twelve years of age who had appendicitis Potts[4] cited only three in the one year old group. Allen[5] reported only one infant under one year of age with acute appendicitis in his series of 612 children with this disease. In still another report[6] of 258 children suffering from this malady not one was under two years of age. A study by Hudson[7] was concerned with 848 children with appendicitis only two of whom were one year of age or less. Studies by Farr[8] and Christopher[9] have given additional data which indicate the rarity of acute appendicitis in the period of infancy.

CASE REPORT

P. H., a previously healthy and well nourished female infant of three months was seen at her home because of fever, irritability, anorexia and frequent crying attacks. The illness had begun twenty-four hours previously. During this period the infant had vomited once and had had one normal bowel movement. When first seen the infant did not appear very ill. A physical examination revealed an acute pharyngitis. The ear drums, lungs and heart appeared to be normal. The abdomen was symmetrical, full and moved freely with respirations. Gentle palpation in all regions of the abdomen appeared to distress the infant. However, there appeared to be no maximal point of tenderness and no abdominal masses were palpated. A rectal examination added no positive information. The temperature was 102°F.

The abdominal findings were interpreted as being due possibly to primary peritonitis or acute appendicitis, and hospitalization was ordered.

The laboratory findings were as follows: red blood cells—4 million, hemoglobin—11 Gm. per 100 cc., white blood cells 21,500; differential count, 68 per cent polymorphonuclear neutrophiles, 30 lymphocytes and 2 monocytes. Urine analysis was negative. Cultures of the urine and blood were sterile. A vaginal smear showed no organisms resembling gonococci. The nose and throat cultures revealed the presence of Staphylococcus aureus, hemolytic streptococcus and pneumococcus.

After a careful physical examination a surgical consultant advised further observation. During the night the infant took her formula well and was reported to have slept between feedings. A re-examination then showed a definite spasm of the rectus muscle in the right lower quadrant. There was also noted a sense of fullness and a definite point of tenderness in that area.

Operation by Dr. Charles B. Jones was performed under ether anesthesia. A McBurney incision was used. The peritoneum was found to be thickened and the vascularity increased. A small abscess cavity measuring 3 cm. was entered and one dram of purulent material evacuated. The walls of the abscess were thin and appeared to have been recently formed. The appendix, which formed a portion of the medial wall of the abscess, was easily identified and removed in the usual manner with inversion of the stump. In the central portion of the appendix was a gangrenous area and a perforation. Three Gm. of sulfathiazole powder were sifted into the abscess cavity and about the neighboring structures. One small cigarette drain was placed in the abscess cavity. The peritoneum and the abdominal wall tissues were then closed in layers.

Convalescence was stormy for the first two days but subsequently there was gradual improvement and the temperature became normal after the sixth postoperative day. Treatment included continuous intravenous infusions of normal saline with dextrose, citrated blood and sodium sulfathiazole. The level of this drug in the blood at no time rose above 5 mg. per cent. Drainage from the operative wound ceased in ten days. A culture of the abscess identified the offending organism as Bacillus coli.

The infant is now six months of age and in excellent physical condition.

COMMENT

Two characteristics of appendicitis in infancy are its insidious onset and the rapidity of its progress to gangrene and perforation. Even if seen in the first twenty-four hours the young patient is likely to have peritoneal involvement. This is usually in the form of generalized peritonitis, although sometimes a localized abscess is seen. It is generally believed that the ability of infants to localize such an infection is limited partly because the omentum in these small patients does not play the protective rôle attributed to it in adults. Moreover, the walls of the juvenile appendix have been described as being very thin and inelastic, thus predisposing to early rupture.[10]

The diagnosis of acute appendicitis in infants presents difficulties not usually seen in older children or adults. Heyl,[11] in referring to the disease in infants stated "it is likely that most in the first year and many in the second recover or die without the real diagnosis being suspected." Peterson[12] is of the opinion that many instances of gastrointestinal upsets, indigestion and colic may be examples of unrecognized appendicitis.

Abt[1] has discussed the diagnostic features of appendicitis in infants rather fully. He found that although constipation was the rule in severe types of infantile appendicitis, diarrhea may occur among the milder types, or diarrhea and constipation may alternate. A complicating generalized peritonitis may cause paralytic ileus with symptoms of bowel obstruction. A high fever may be present and polymorphonuclear leucocytosis is nearly always found. Vomiting, abdominal pain, distention and tumor mass were features of some of the cases discussed in Abt's review. This author emphasized that tenderness at McBurney's point is of diagnostic importance but that it cannot always be elicited. He added that the appendix may be deep and that abdominal tenderness may be greater on the left side than on the right, or that it may be deflected upward. A rectal examination is of great importance in such cases. Abt also analyzed his series of collected cases by age groups of from birth to three months, three months to six months and from six to twelve months.

The writer has studied a number of other published reports of acute appendicitis which occurred in infants less than one year of age. These publications show that this disease may occur at any time during the first year of life.

Several papers described what appeared to be acute appendicitis in the prenatal and the newborn periods.[13,14,15,16] Descriptions conforming to the classical picture of the disease as seen in adults were included.[17,18]

Campbell,[19] Ham,[20] Pope,[21] Langston,[22] and Rivarola[23] cited examples of acute

appendicitis complicating strangulated inguinal hernia in infants under one year of age. Abt's review[1] listed ten examples of this type. Burger,[24] O'Neill[25] and Lilienthal[26] also described hernial appendicitis in young infants. Gundobin[27] investigated the length of the appendix in a number of infants and found that the length varied from 3.4 cm to 11.6 cm. In 60 per cent of the cases examined the appendix extended into the small pelvis. McCarthy[28] is of the opinion that a long appendix might be caught in a hernial sac and thus become incarcerated, inflamed and gangrenous. The clinical picture of hernial appendicitis resembles that of strangulated hernia. In the former, however, the mass is tender and the overlying skin is soon likely to become red and hot suggesting the presence of an abscess. Black[29] has recently described an unusual case of an infant fourteen days of age with hernial appendicitis in which the appendix was contained alone in the sac.

Intussusception may be closely simulated by acute appendicitis in young infants. Coleman[30] saw an infant girl of five months who had been periodically screaming and drawing up her legs for nine hours. Bright red blood and mucus were passed by rectum. She had vomited once. The temperature was 100.2°F. A rectal examination was negative. Abdominal examination under anesthesia revealed a small lump deep under the right costal margin. Operation revealed an acutely inflamed appendix and free fluid in the abdominal cavity. There was no intussusception present. The lump was later thought to be the right kidney which had a prominent fetal lobulation. John,[31] Somers,[32] Heekes[33] and Crosier[34] described similar instances in young infants in which a preoperative diagnosis of intussusception was made, and although this condition was simulated clinically, acute appendicitis was found at operation.

As stated above many infants with with acute appendicitis are first seen by a physician after generalized peritonitis has complicated the original lesion. Vomiting, fever, distention, abdominal tenderness and either diarrhea or bowel obstruction associated with paralytic ileus may then be seen. If long continued, the resultant loss of fluids and electrolytes leads to dehydration, acidosis, stupor and collapse. It is the writer's opinion, based in part on some personal observations, that after a few days of such an illness, abdominal distention previously present may disappear and abdominal tenderness may no longer be detected. Kempton's[35] patient, when first seen by him on the eighth day of illness had neither abdominal distention nor muscle spasm, and yet autopsy revealed a perforated appendix and generalized peritonitis. Such an infant may be indistinguishable from one suffering with gastroenteritis with dehydration acidosis Incidentally, the opinion is held by some that enteritis may predispose to an attack of appendicitis.

In considering the differential diagnosis of acute appendicitis in infancy intussusception, gastroenteritis and hernial appendicitis have been mentioned. Pneumonia, intestinal obstruction, pleurisy, ileopsoas abscess and typhoid fever (rarely) are frequently confused with appendicitis.[1]

Primary peritonitis may be very difficult to distinguish clinically from acute appendicitis, or from peritonitis secondary to a ruptured appendix. Ladd,[36] however, advocates an operation "of a limited sort" for suspected primary peritonitis. During the course of this operation the status of the appendix is determined, and if involved in the infection it is dealt with in the usual manner.

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COMPLEX TRIDERMAL TERATOMA OF THE STOMACH (BENIGN)

CASE REPORT

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TRIDERMAL teratoma of the stomach is a very rare condition and extensive search of the literature fails to record such a case. Boyd,[1] Ewing[2] and Ballantine[3] fail to report a single instance. Eustermann and Balfour,[4] discussing non-malignant tumors of the stomach found at the Mayo Clinic, report twenty-six benign tumors, none of which was a teratoma. Lexer,[5] Askanasy,[6] Hosmer,[7] Marchand,[8] Ahrens,[9] and Englander[10] have reported cases of tridermal teratomas of the peritoneum but these tumors were either situated behind the liver or located in the transverse mesocolon. Some of the latter were difficult to distinguish from retroperitoneal tumors. Brouha,[11] and Schonholzer[12] describe several unattached tridermal teratomas occurring retroperitoneally. Borst[13] and Bolzana[14] describe several cases derived from the ovary and also retroperitoneal. Polony[15] described a case of exogastric teratoma occurring in a six year old child. Covered by the gastrocolic ligament, the tumor was attached to the stomach by a pedicle. It consisted of numerous cysts containing a stringy fluid and gelatinous, purulent or caseous masses. Many of the cysts were secondarily infected. Histologically, the cysts were closed and many were lined with epithelium of a digestive type but without glands. The stroma and intracystic septa were composed of connective tissue and muscle fibers. Differentiating it from a Schwannoma by the absence of neuro tissue he made the diagnosis of simple teratoma with secondary infection.

Teratomas of other organs such as thyroid, brain, testicle, ovary, kidney and others, are very common but the absence in the literature of a case of complex tridermal teratoma of the stomach (benign) and the fact that it was successfully removed from a child four months of age, is the purpose of this report.

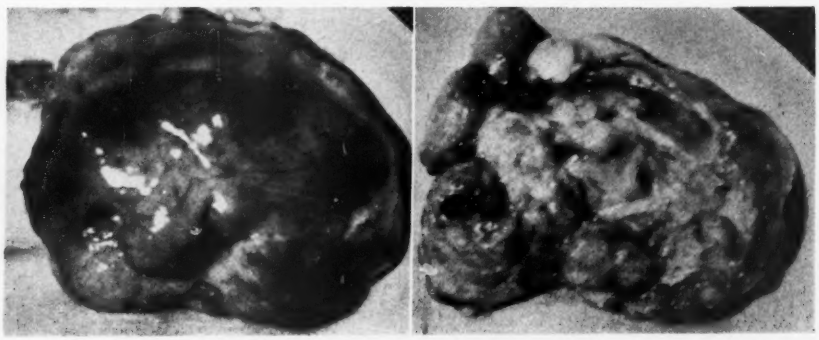
CASE REPORT

E. B., a male, white child, was born at term May 30, 1941. The delivery was normal, birth weight seven pounds, seven ounces. Circumcision was done on the eighth day and the wound healed rapidly without incident. The child appeared normal except for a hemangioma one inch in diameter present in the midline, about two and one-half inches above the umbilicus. Routine examination at the age of six weeks revealed no abnormalities. The weight at this time was eight pounds, twelve ounces. The hemangioma apparently had not grown any in size. The liver and spleen were palpable, otherwise the abdomen felt normal. The child was taking its formula well, the bowels were moving satisfactorily and the stools appeared well formed and brown in color.

Routine examination on August 28, 1941, at the age of three months, revealed a large mass occupying the whole upper left quadrant of the abdomen extending down below the umbilicus. The mass was freely movable and not adherent to the skin and apparently not tender to touch. It could be shifted up beneath the ribs with ease. The liver was palpable but not so the spleen. The hemangioma had not noticeably changed in size. The child weighed eleven pounds and six ounces, was taking its feedings well, the bowels were moving well and there was no blood in the stools or urine.

The child was admitted to Nyack Hospital for *x*-ray studies. Flat plates of the abdomen were taken on August 29, 1941. The roentgenologist reported, "There is a rather large, roughly, spherical mass in the left side of the abdomen occupying most of the upper left

quadrant and extending down below the umbilicus. It seems cystic in consistency but the origin is not clear. It does not seem that the spleen is displaced." On September 4, 1941 blood count revealed—hemoglobin Sahli 70 per cent (14.0 Gm.), red blood count 3,800,000, white blood count 8,000, neutrophils 32 per cent, lymphocytes 56 per cent, mononuclear leucocytes 10 per cent, eosinophils 2 per cent, blood smear showed some hypochromia. The Wassermann reaction was negative. On September 5, 1941, an intravenous pyelogram was done. The roentgenologist reported, "The large amount of stool and gas in the intestines and gastric distention with gas make clear visualization difficult. The dye is apparently excreted well as shadows of the bladder are obtained very promptly. The calyces and pelves of the kidneys are not seen. The outline believed to be the kidneys did not correspond to the palpable mass." The child was examined by numerous members of the surgical staff at the hospital and these concurred in a diagnosis of probable Wilms tumor of the left kidney, although they were not able to rule out intraperitoneal lesion completely. Urological consultation agreed with the probable diagnosis of a kidney lesion. Arrangements were made for operative intervention, and this was done on October 3, 1941.



A B

FIG. 1. A, gross appearance of the tumor, 15 by 10 by 8 cm. B, the tumor sectioned in half.

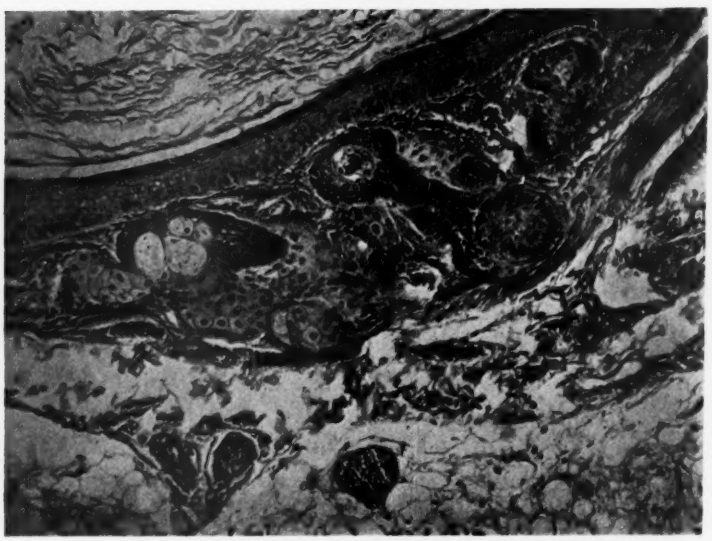


FIG. 2. Microphotograph showing area of skin with keratin layer, and true derma containing sebaceous glands, hair follicles and fatty tissue.

Drop ether was used for anesthesia. Because of the doubt as to the exact lesion, I chose an incision about one inch lateral to the outer border of the rectus intending to add a T if a kidney lesion was found. On approaching the peritoneum it became obvious that the lesion was intraperitoneal. The peritoneum was incised in the line of the skin incision and the

abdomen explored. A fibrocystic mass almost six inches in diameter was found in the upper portion of the abdomen. It was delivered through the incision. Further examination found that it was growing from the stomach. No palpable glands were noted about the stomach and there was no involvement of the liver. The mass was not adherent to the adjacent organs and was attached to the stomach anteriorly on the greater curvature about half way between the cardia and pylorus by a broad base. Clamps were applied to the stomach beyond the base of the mass and the entire mass removed *in toto*. Inspection of the stomach inside and without showed no other involvement. The large rent in the stomach was closed with one row of through-and-through interlocking sutures covered over by two rows of continuous seromuscular Lembert sutures. The abdomen was closed in layers without drainage. Three silk through-and-through sutures were used as retentions. The convalescence was uneventful.

Clyses of 150 cc. 3 per cent glucose in saline were given every four hours for the first twenty-four hours, every six hours for the second twenty-four hours and twice during the third twenty-four hours. Dextrimaltose in water, by mouth, was started twenty-four hours postoperatively and continued every two hours for twenty-four hours. A milk formula was commenced after forty-eight hours and orange juice and cereal were added on the sixth day. Sutures were removed on the ninth day and the child was discharged on the thirteenth day postoperatively. The wound healed and the child was taking its regular feedings.

The child has continued to thrive and develop normally since leaving the hospital and when last examined on December 1, 1941, was found to weigh fourteen pounds six ounces. The wound has healed solidly and there have been no digestive or other disturbances of any kind.

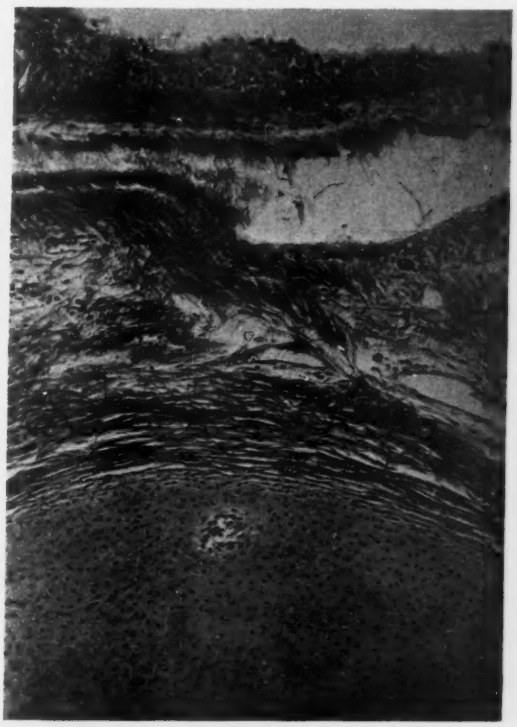


Fig. 3. Microphotograph showing bronchus with cartilage, smooth muscle and mucosa.

Pathological Report by Dr. W. R. Strutton. Gross Description: The tumor was a bluish white, rounded ovoid mass 15 by 10 by 8 cm. covered by a fibrous-like tissue with cystic areas showing beneath the capsule. On section

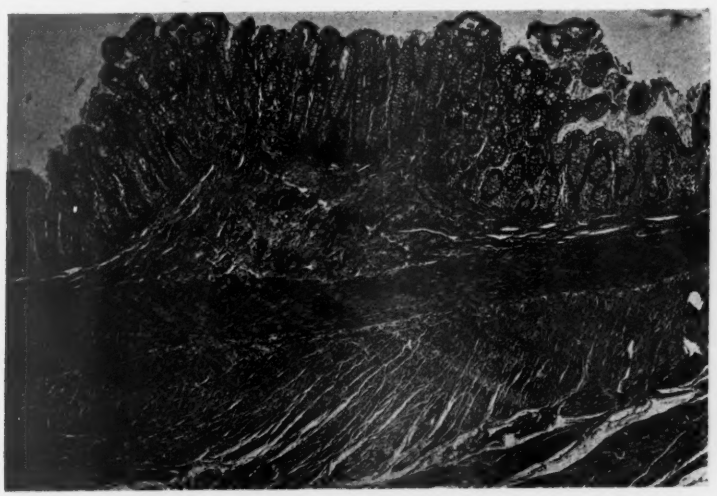


Fig. 4. Microphotograph showing intestinal structures found—colon.

it showed numerous cysts, tough fibrous areas, cartilage and some hemorrhagic areas. On palpation it showed numerous areas irregularly hardened, soft and tough to touch, with cysts extending through the cut surface, interspersed with hardened cartilagenous, whitish areas, tough fibrous interlacing partitions giving a variegated appearance to the cut surface. The tumor was attached to the stomach wall by a base 5 cm. in diameter. This base was intimately adherent through the serosa and muscularis and covered only by gastric mucosa.

Microscopically, sections showed a multiplicity of tissues, the best defined being skin with hair follicles, sweat glands, fibrous, fatty and myxomatous tissues. Other areas showed smooth muscle, blood vessels, serous cysts lined by flattened epithelium, a deeply pigmented surface of cartilage, poorly defined, but suggesting bronchi, mucous membranes lined by tall columnar epithelium containing mucus, tubular glands and other areas of transitional epithelium. The tubular glands resembled colon and stomach tissues.

Diagnosis: Complex teratoma (benign).

The tumor was also viewed by Dr. Fred Stewart of the Memorial Hospital, New York City, who took sections and made slides. He concurred in the diagnosis, calling it a complex tridermal teratoma—benign. Dr. Sidney Farber of the Children's Hospital in Boston, viewed the slides and also concurred in the diagnosis.

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TORSION AND GANGRENE OF HYDATID OF MORGAGNI*

REVIEW OF LITERATURE AND CASE REPORT

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VESTIGES of anlage of the genito-urinary systems remain in both sexes in the adult. Most of them are rudimentary, small structures and cause no pathologic manifestations in adult life. One of these structures was described by Morgagni in the seventeenth century and has been known since as the Hydatid of Morgagni. Other correct terms are the vesicular appendage or appendix vesiculosa of the Fallopian tube, or testis. It is peculiar in that it represents an embryonic vestige, which is not utilized in the adult in either sex. Because of this, it remains a relatively similar structure, except in position, in both the male and female. These hydatids are thought to be remnants of the segmented cephalic mesonephric tubules which do not enter into the formation of either the epoophoron or the paroophoron.[1,2] Arey[3] believes that they may also represent a cystic rudimentary Muellerian funnel accessory, formed when the Muellerian duct begins to roof over the cleft from which it is formed.

In the female adult, these structures appear as ovoid to spherical hydatids, usually with a small pedicle, hanging from the broad ligament, just below the fimbria of the tube. They usually are anteriorly placed.[4] They may appear as two or three fused vesicles with constrictions between each segment.

In the male adult, these hydatids, known as the appendix of the testis, appear as minute oval, sessile bodies, attached to the upper extremity of the testis,[4] just beneath the head of the epididymis.

The size of these hydatids varies, but they are usually about .9 cm by 1.0 cm. They may be sessile, but ordinarily they have a pedicle, which may reach one inch in length. The length of the pedicle undoubtedly plays a part in the torsion of such a hydatid.

Apparently, the pedunculated hydatid is relatively common, as many are seen during routine pelvic explorations.[32] In this case, torsion of hydatids, with acute symptoms, might be common. However, this is not so. In reviewing the literature we found reports of only thirty-nine cases. Of these, twenty-six, or 66.67 per cent have been in male patients. The remainder, thirteen, or 33.3 per cent have been in females. The higher incidence in males is thought to be the result of the motility of the testis, hanging free in the scrotum. Add to this, a hydatid, itself with a pedicle, and it is easy to see how torsion can occur. The usual manifestations of torsion in the male, are similar to those of torsion of the testis itself; in a high percentage of cases this has been the preoperative diagnosis. However, Mouchet[8] saw four cases in which there was a "silent" torsion, with symptoms over a considerable period. Also, it is possible to have the development of a hydrocele, as reported by Contiades[13] with the diagnosis of a traumatic orchitis.

In the male, with bilaterally descended testicles, the usual findings are in the scrotum; hence, there is little confusion between the symptoms of torsion of testis, cord or testicular appendage, and those of acute abdominal disease.

In the male with ectopic testicles, torsion of a hydatid of Morgagni will cause symptoms dependent upon the position

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of the ectopic organ. That this may and does occur is evidenced by the cases reported by Monclav[14] and also by Chidi-

FIG. 1. (Cook County Hospital No. 41-68813). Photograph of a hemorrhagic, gangrenous hydatid of Morgagni found in a white female, fourteen years of age.

chimo.[34] In the latter's case the patient had a strangulated hydatid, with a cryptorchid and congenital hernia. The findings were those of the acute surgical abdominal catastrophe. The remaining reports of cases in males record no features at variance with those of Bonnet[7] and others.[8–13,15,17–18,20–21,23–24,26–27,29–31,34–36]

It is in the female, in whom the hydatid of Morgagni is normally found in the abdomen, that one may expect to find torsion representing the picture of acute abdominal disease. The preoperative diagnosis is seldom if ever made, the most usual impression being that of either acute appendicitis or twisted ovarian cyst. Waugh[32] points out that the reports in the literature indicate that more of these hydatids with torsion are found on the right side. He accounts for this fact with the observation that right sided abdominal pain is viewed as more serious and hence laparotomy is advised, whereas left sided abdominal pain is usually conservatively treated. There are no reports in the literature of torsion, strangulation and gangrene of a hydatid of Morgagni causing death. This may be accounted for by the fact that the hydatid is small, and does not communicate either with a fecal containing viscus or any functioning organ. Waugh[32] believes that the frequency of this picture of torsion must be greater than reports indicate, and that many must have been overlooked when a benign appendix was removed. The succeeding clinical picture occurring as a result of the gangrene of the hydatid could be misinterpreted as "gas pains" or some other such complications of the appendectomy.

The first report of torsion of a Morgagni hydatid found as a cause of acute abdominal disease was made by Andrews[5] in 1912. The patient was six months pregnant. Apart from this complication, the subsequently reported cases vary little.[6,16,19,22,25,28,32,37]

The most frequently encountered clinical findings are similar to, often less severe than those of an ovarian cyst with twisted pedicle. The onset is usually acute, of varied severity, with from moderate pain to extreme prostration. This initial pain is soon replaced by crampy, colicky pain, with increasing severity, and shorter intervals which are pain free, until as torsion is completely established and hemorrhagic infarction occurs, the pain is steady and dull. The physical findings are moderate to severe tenderness in the lower quadrant of the affected side, somewhat lower than one might expect in acute appendicitis. On pelvic examination, there may be extreme tenderness upon manipulation of the adnexa of the affected side. Frequently, however, the patient has been a young girl and pelvic examination has been hampered by an intact hymen.

Because of the infrequent occurrence of torsion of hydatids of Morgagni in the female, the following case is reported. It is the fourteenth recorded case.

CASE REPORT

M. S. (No. 41-68813), a white female of fourteen years of age, was admitted to the Cook County Hospital on December 10, 1941. Her complaints upon admission were cramp-like, colicky abdominal pains beginning nineteen hours previously. She had menstruated from December 4 to 8, a period normal in every

respect. The onset of the colicky pain was in the right lower quadrant, severe, causing her to stay in bed from the onset. After the first pain, which stayed with her steadily for one hour, the character of the pain changed. Instead of the steady pain, there occurred wave-like pains, lasting from one to three minutes, which would then disappear, leaving her fairly comfortable in the interim. At first these pains were about thirty minutes apart, but the interval between pains was getting shorter, so that on admission they were occurring almost continually. About 5 P.M., ten hours after onset, she vomited food previously taken, which was a glass of milk taken at 3 P.M. At 12:30 P.M. she had a normal bowel movement which had no effect on the pain.

The inventory by systems was essentially negative. The menses had begun at eleven years of age; there were twenty-eight day intervals, with a moderate four-day flow.

Physical examination revealed a well developed, well nourished white female of fourteen, acutely ill. Her temperature was 99.8°F. rectally; pulse 68–74, blood pressure 116/75.

Head, neck and chest were negative except for slight hyperemia of the pharynx. The abdomen was scaphoid; liver, kidney and spleen were not palpated. No masses were palpable. There was moderate tenderness over McBurney's point on deep palpation but no rebound tenderness. Psoas, obturator and Rovsings signs were negative. Rectal examination revealed nothing abnormal. The external genitalia were normal and the hymen intact.

Laboratory workup was as follows: Vaginal, urethral smear negative for gonococcus; urinalysis negative; white cell count 16,500.

A tentative diagnosis of ruptured corpus hemorrhagicum was made, and conservative treatment instituted, with frequent re-observations. It was felt that the repeated colicky type of pain did not indicate appendicitis and that a pelvic lesion was more likely.

The patient spent an uncomfortable night, the colic recurring, perhaps somewhat less intense the first part of the night. Eight hours later, or about twenty-four hours after onset, the white blood count was 18,500. There was definite right lower quadrant rigidity, tenderness and rebound tenderness. A probable diagnosis of acute appendicitis was made and laparotomy performed.

Under ether, nitrous oxide and oxygen anesthesia a McBurney incision was made. A normal appendix was easily delivered. The terminal 25 cm. of ileum was examined and found to be normal. It was then noted that there was a small amount of sanguineous fluid escaping from the right side of the pelvis. The McBurney incision was extended into the rectus sheath, as advocated by Weir, and the right adnexa delivered. Observed on the anterior surface of the right broad ligament, just below the fimbria, was a twisted, hemorrhagic Morgagni hydatid of 10 by 8 mm. The remainder of the right adnexa was normal. The hydatid was removed by ligature and excision of the base; the tube and ovary were left undisturbed. Hemostasis was effected with suture. Peritonization of the raw surface of the stalk of the hydatid was effected. The appendix was removed and the stump inverted. The peritoneum was closed with catgut, the fascia, muscles and skin with interrupted steel wire .010 mm. in diameter. The patient made an uneventful recovery and left the hospital on the sixth postoperative day. She has been followed for four months, has a normal menstrual history, and no further right lower quadrant pain.

It would seem to be good judgment during exploration of the right lower quadrant for a suspected acute appendicitis, to investigate the adnexa for such strangulated hydatids, in the event that the appendix is not the cause of the trouble.

In the event of torsion and strangulation of a hydatid of Morgagni, the treatment of choice is ligation and excision, with peritonealization of the base.

SUMMARY

1. A brief embryologic discussion is presented as to the origin of hydatids of Morgagni.

2. A review of the literature has shown that torsion of such hydatids has been reported in thirty-nine instances.

3. Torsion of hydatids of Morgagni occur more commonly in the male, the ratio being two to one.

4. A brief discussion of the symptomatology and physical findings is presented.

5. A case of torsion of a right hydatid of Morgagni in a girl fourteen years of age, treated by ligation and excision, together with an appendectomy is reported.

6. It is suggested that in all cases of right lower quadrant pain, if a normal appendix is found at operation, the right adnexa be inspected for torsion of such hydatids.

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LUXATION OF TESTES

CASE REPORT

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SPORADIC cases of traumatic dislocation of testicle are occasionally reported and the reader is always reminded of the rarity of such condition. The earliest case on record was reported by Claubry in 1818. Luxation may be of one or both testicles, may be simple or compound, but the latter is considered extremely rare. Only three cases were collected by Alyea in 1929 and in 1940 Miller and Mickley reported one case of compound dislocation of both testicles. C Lewis Gaulden, of Los Angeles, found only five cases of dislocation of both testicles in 1922 to which he added a case of his own. While in some of the cases reported the exact nature of the trauma producing luxation was not described, the great majority of dislocations were caused by direct trauma to the part or adjacent areas. Herbst and Polkey gave an excellent review of all cases reported up to 1934. They summarized some ninety-three cases collected; sixty-six were simple dislocations of one or rarely both testes, and twenty-seven were so-called "herniae testes." Of the sixty-six cases of simple dislocations, forty-three were due to direct trauma, three had no reported cause, eleven were caused by effort trauma and seven by mechanical prevention of descent of congenitally undescended testes, such as the use of truss for false diagnosis of hernia. That review did not include cases of self-mutilation by bandage, truss or ligature. Seven of such cases were reported and nearly all were in the Russian army. Of the twenty-seven herniae testes reviewed, two occurred during an operation on the cord, the rest by direct trauma. There were three cases of simple dislocation of both testicles, two of compound dislocation, four were penile, six anal, one crural and one into the hip joint. All others were toward the inguinal region and into the canal.

Spontaneous reduction was accomplished in a few cases, but the majority were reduced by operation. In six cases castration was necessary. Two patients died from the injury, one by the nonreduced dislocation becoming cancerous, and the other from herniation shock. Dor reported a case of Donnet in 1937 in which luxation of both testicles occurred which was reduced surgically. McCrean, in 1938, reported a case of spontaneous reduction four days after the injury which caused the ectopia although gentle manipulation failed two days before. The case reported at this time is a case of luxation "par effort."

CASE REPORT

H. T. R., age forty-two, a white, American born, airline worker and veteran of World War I, with several subsequent enlistments in military service, was admitted to Caledonian Hospital complaining of a painful mass in the right groin. The following history was obtained:

On February 24, 1941, about 10 P.M., he was coming down a ladder carrying a propeller dome, which began to slide off his arms but was held as he came down to the ground with some force. He felt faint and experienced a tearing sensation in the right groin, but continued to work until the afternoon of February 27, 1941, when the pain became intense. A physician was then consulted and a diagnosis of strangulated hernia was made. The correct diagnosis of luxation of right testicle was arrived at upon admission when an empty right scrotal sac was discovered. The testicle was felt above Poupart's ligament and could not be reduced manually. An operation was performed on March 3, 1941, and a strangulated testicle was found resting on the aponeurosis of

the right external oblique muscle, above and lateral to the external inguinal ring. The organ was surrounded by particles of blood clots. The spermatic cord was twisted, contracted and enlarged to three times its normal size. The testicle was dark blue in color due to interference with its blood supply by the congested and strangulated cord as it emerged through the external ring. The ring was open and the cord dissected up into the pelvis but the blood supply remained impaired and the cord contracted. The removal of the testicle was deemed advisable. The cord was divided between two ligatures and the stump sutured to the border of the internal oblique muscle. The fascia of the external oblique muscle was repaired as in a herniorrhaphy. The postoperative course was uneventful.

Pathological Report. "Gross specimen consisted of a testicle the tunica of which is hemorrhagic on section. The upper pole shows hemorrhagic areas. Histology: Section of the testicle and epididymis shows marked edema, cell infiltration and hemorrhagic infarcts particularly in the epididymis."

SUMMARY

One case of traumatic dislocation of testicle is reported making a total of 100 cases reported to date, including the herniae testes.

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PRIMARY HODGKIN'S SARCOMA OF THE JEJUNUM WITH PERFORATION RESECTION AND RADIOTHERAPY

CASE REPORT

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THE infrequent occurrence of primary Hodgkin's disease of the small intestine and the singular circumstance which resulted in the perforation of a loop of the jejunum, associated with an extensive inflammatory process of the gut and the atypical clinical findings, are all interesting observations which make this case worthy of publication.

Hodgkin's disease is today a well recognized morbid entity characterized by specific histopathologic lesions of the lymph glands and the lymphoid tissue of the body, associated with an anemia, a varied symptomatology and a fatal course. In reading the literature, all the various synonyms for the disease may create considerable confusion as to classification and causation and yet the histologic picture and pathologic behavior has remained so contant for the past four decades as to avoid any possibility of confusion.

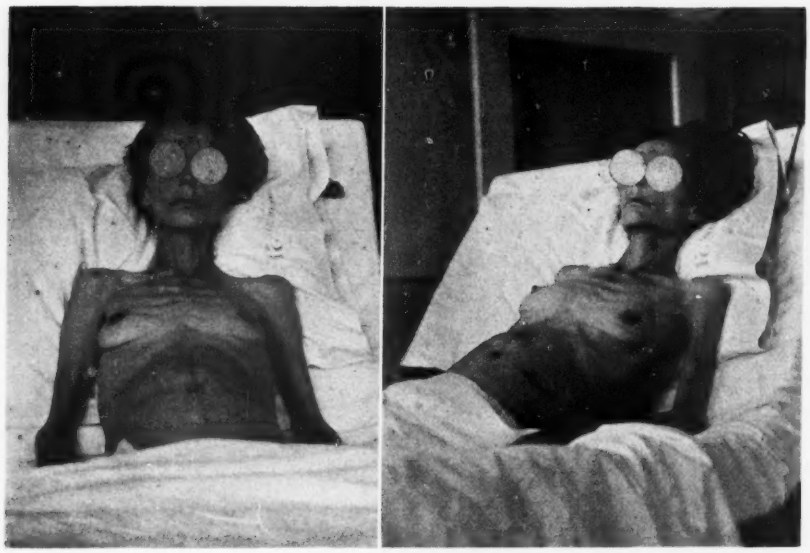
The disease is of relatively low frequency; it seems to occur twice as frequently in males as in females. Heredity, environment, occupation and food play no important rôle. It attacks all races and all nationalities alike. The reports of cases in America seem to indicate that the distribution is more among the whites and the American born (a study of 214 cases by Peirce, Jacox and Hildreth at Michigan).

It can occur at any age but the largest number of patients are observed during the second and third decade of life. Smith collected five cases in which the onset was before the sixth month of age. The youngest patient recorded in the literature is that of Priesel and Winkelbauer, a girl four and one-half months old who died of this disease which had been present since birth. A cervical node removed from the mother in the last month of pregnancy showed Hodgkin's disease.

Notwithstanding the extensive research work done since 1832 when Hodgkin's first series of cases were presented, the etiology of the disease still remains obscure. Opinions are conflicting as to causation. Some observers attribute it to various types of chronic infections including tuberculosis; the majority of investigators lean more toward the theory that it is of neoplastic origin. Sternberg (1898) maintained that the disease was closely related to tuberculosis, whereas Reed (1902) believed that the process is an infective granuloma of unknown cause. Both clarified the histologic picture of the disease by placing particular emphasis on the findings of multinuclear giant cells, the Sternberg or the Dorothy Reed giant cells.

In 1932, Gordon described a test which is a valuable confirmatory test when accompanied by positive histologic examination. He injected intracerebrally a broth suspension of diseased lymph-nodes into rabbits and guinea pigs. This was followed by a syndrome (bearing his name) of spastic paralysis, ataxia, retraction of the head, fits and loss of weight. The test was positive in 70 per cent of his cases. Gordon believed that the disease was caused by a virus. Steiner found the test positive in 73.9 per cent of 299 recorded cases of histologically proved Hodgkin's disease and falsely positive in only 1.77 per cent of 452 control cases. In 1938, several independent workers (D. S. Edward,

McNaught, J. B. Turner, Jankson, and Parker) demonstrated that the Gordon syndrome was caused by the eosinophils present in the tissues affected by Hodgkin's disease and that the same syndrome can be produced by other tissues containing eosinophils.



A B

FIG. 1. A and B, showing patient with marked cachexia.

Epstein in a series of cases gathered from the literature emphasized the fact that the disease is not only less frequent in females, but that one-half or more women with Hodgkin's disease survive more than five years and that one fifth survive ten years. His findings are not in harmony with those of other observers.

Finzi, at the Fifth International Congress of Radiology in 1937, reported cases of patients who lived as long as eighteen years without evidence of active disease. Best results have been obtained in patients in whom the disease was confined to the cervical region and treated by heavy irradiation. Finzi believes that when the disease is localized it can be cured.

In a large percentage of cases the disease seems to begin with a painless enlargement of lymph-nodes in the left side of the neck. Many investigators have pointed out that this region is the most common initial involvement. As the disease progresses, certain constitutional symptoms appear, viz., loss of weight, weakness, loss of appetite, pallor and myelopthisic anemia. Fever is present during the course of the disease in most all cases. Some cases show the Pel-Ebstein variety of pyrexia, (febrile periods persisting for two or three weeks, alternating with afebrile periods of a week or ten days' duration). In advanced cases there is marked elevation of pulse out of proportion to the temperature. Fever is usually a sign of deep structure involvement.

The blood picture does not show any special characteristics of the disease; 16 per cent show a leukocytosis and 5 per cent have eosinophilia. Anemia is always present in those patients with systemic symptoms. Some workers have demonstrated the co-existence of Brucella infection and Hodgkin's disease by isolating the Brucella melitensis from blood or lymph-nodes. These observations do not establish an etiological relationship to Hodgkin's disease and it suggested that the clinical course of Hodgkin's disease may be influenced by Brucellosis.

The following is the order of the sites of origin most commonly found: Left neck, right neck, both sides of neck, mediastinum, right axilla, left axilla, left groin, right groin, both groins, spleen, stomach, intes-

tines, nose, nasopharynx, spine, right humerus, sternum, skin, heart, pericardium, pleura, lung and brain.

Additional symptoms are diarrhea or constipation, distention and diffuse abdominal tenderness. In some patients

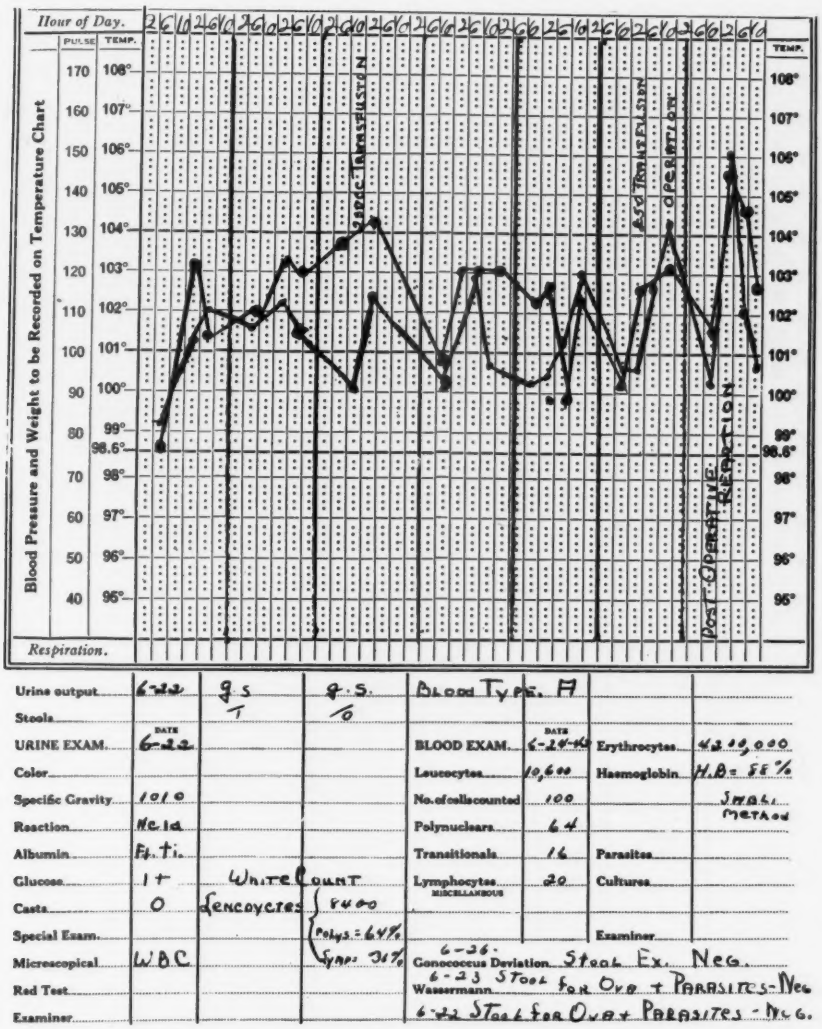


FIG. 2. Temperature chart for June 21st to June 27th.

Abdominal Hodgkin's disease presents great diagnostic and therapeutic difficulties, especially in cases in which there is no enlargement of the superficial lymph glands. In the early stages of the disease the symptoms are referable to the organ involved and in the absence of systemic symptoms, viz., fever, loss of weight, pruritus, etc., considerable time is lost before the diagnosis is made. Abdominal symptoms are common and in some patients they are the initial ones. Abdominal pain, simulating a gallbladder syndrome or peptic ulcer, is not uncommon.

there may be generalized brownish pigmentation, or the discoloration may be irregularly distributed, giving a mottled appearance. Occasionally, there may be an actual infiltration of the skin, producing small nodules. An extreme degree of pruritus may be an early and annoying symptom which sometimes constitutes the patient's chief complaint. The disease begins as a localized process and the prognosis depends on irradiation before generalization takes place.

In Hodgkin's disease of the small intestine, it should be recalled that scattered

over the mucous membrane of the entire length of the intestine there are numerous minute, soft, rounded bodies composed of

Where lymph-nodes are accessible, if excised and followed immediately by roentgen irradiation, this combined treatment

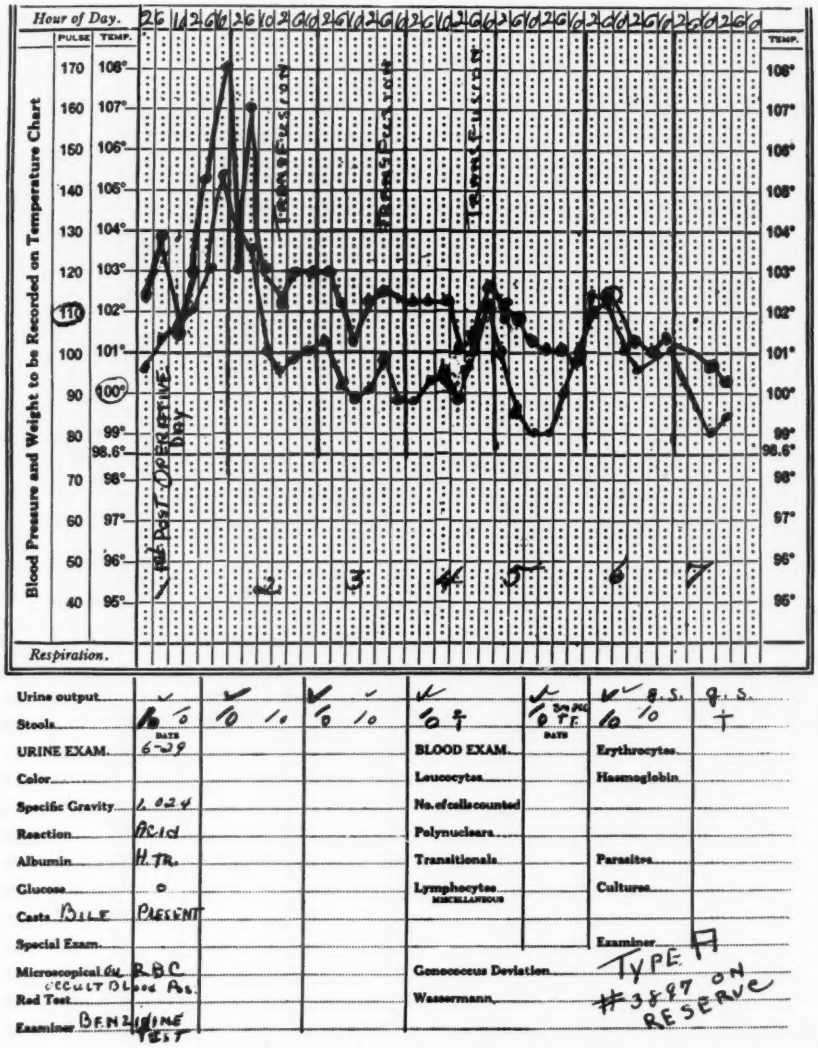


FIG. 3. Temperature chart for June 28th to July 4th.

retiform tissue, constituting the solitary glands. The aggregation of these solitary glands form Peyer's patches. These patches are more numerous in the lower ileum, and it is in these lymphoid structures that the disease affecting the small intestine most likely originates.

X-ray examinations offer invaluable aid in diagnosis. It helps to determine the seat and extent of certain deep lesions; it aids in the verification of the regression after treatment and the extension after recurrence.

seems to give better results. Most observers prefer methodical radiotherapy. In their opinion it brings about pronounced remissions and prolongs life.

CASE REPORT

C. S., a white female twenty-nine years old, para 1, with a child sixteenth months old and well, had never been acutely ill in her life. Six months before she began to have attacks of diarrhea, the daily movements averaging from six to eight per day. Shortly after she began to complain of anorexia, weakness and loss of weight. The attending physician treated her

as a case of incipient tuberculosis. Three months later besides the enumerated symptoms, fever of low grade made its first appear-

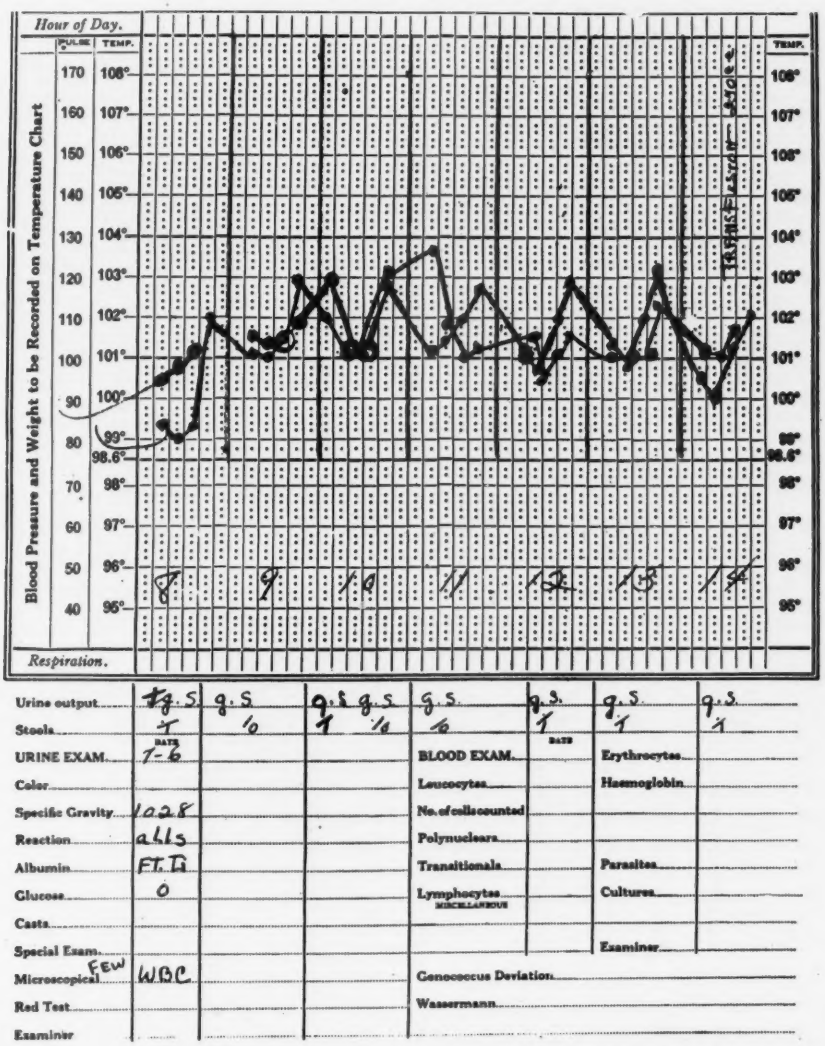
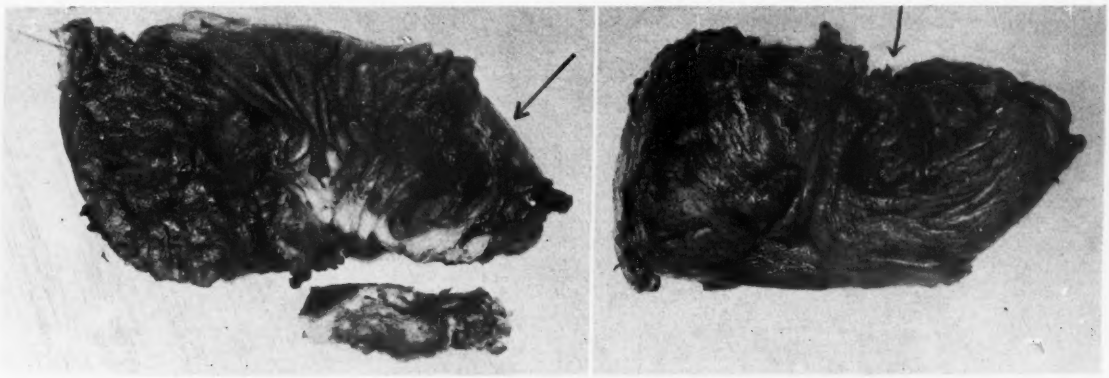


Fig. 4. Temperature chart for July 5th to July 11th.

ance. Other physicians were called on the case and in spite of negative *x*-ray finding of the chest and that there was no cough present, the treatment was continued along the lines of pulmonary tuberculosis. In the fourth month of her illness, the patient was interned in a hospital, where she remained for a month and was discharged with the diagnosis of ulcerative colitis. The patient came to the author's attention who had her admitted to Morrisania Hospital with the presumptive diagnosis of degenerating diverticulitis.

The patient was chronically ill, markedly emaciated and complained of anorexia, diarrhea, asthenia, loss of weight, fever, with afternoon excursions reaching from 103–104°F. There were no sweats but there were left upper and middle abdominal quadrant pains, associated with vomiting twenty to thirty minutes after meals. There was no history of hematemesis, melena or mucus in the stools no hematuria, pruritus, no cyanosis, dyspnea, cough or jaundice. Scattered over the forehead and cheeks there were areas of dark pigmentation. Superficial lymph-nodes were normal in appearance and distribution. The lungs produced crackling râles over the fourth and fifth ribs anteriorly. The abdomen was not as emaciated as the rest of the body; tenderness was present in all the quadrants, but in the left upper and middle quadrants, tenderness was greater and an ill defined mass could be palpated there. Vaginal and protoscopic examinations showed no abnormality. Blood examination revealed 12,600 white blood cells, 64 polymorphonu-

clears, 16 transitional, 20 lymphocytes, hemoglobin 88 per cent. This blood examination was repeated several times, looking for eosinophilia and for any informative material. The patient at this time had received many transfusions and that in itself would have somewhat altered the true blood picture. Blood sedimentation was 16; blood cultures were negative, also for Brucella. Stools were negative for tuberculosis organisms, ova or parasites. Urine and Widal tests were negative.



A B

Fig 5. A, showing inner surface with eroded area; B, posterior view of jejunum with eroded area.

On June 26, six days after admission, a laparotomy was performed with a left rectus incision. Operative findings disclosed a loop of thickened inflamed jejunum, with many verruca-like excrescences, 1 to 2 mm. in diameter on the serosa. The loop, horse-shoe shaped, had large mesenteric glands in its concavity and the convex portion of the loop was plastered and covered by the omentum and transverse colon. There was no free fluid or fibrin seen in the peritoneal cavity. There was no distention of the small bowel or colon proximal to the lesion. The affected loop with blunt dissection was gently separated from the omentum and the colon. The colon did not show much gross pathological disturbance but on the convex surface of the loop there was an eroded area about 2 cm. in diameter; evidently a slow perforation of the jejunum had taken place and the omentum with the colon had been supporting the gnawed jejunal wall. About 20 cm. of what appeared to be diseased jejunum was resected and a side-to-side anastomosis was performed. The mesentery was studded with glands averaging from pea to walnut in size and considerable bleeding was encountered in ligating the mesenteric vessels. The mesentery, evidently made up of merging tumor tissue, was very friable. Three to 5 Gm. of sulfanilamide was thrown in the region of the anastomosis and the abdomen was closed in layers without drainage.

The patient was a poor surgical risk. The morning of the operation she had a temperature of 104°F. and the postoperative reaction brought the temperature to 106°F.

Macroscopic examination revealed the small intestine to be about 20 inches long, the wall markedly thickened, varying from ½ to 1 inch, the lumen considerably dilated, mucosa hypertrophic; one area was necrotic and appeared constricted.

Biopsies taken from various portions of the resected loop showed similarity of structure, which was characterized by complete obliteration of normal structure from mucosa to serosa with diffuse replacement by lymphomatous tissue. The cells were variable in size and appearance, showing hyperplasia of reticulum cells and lymphocytes. Numerous giant cells of the Reed-Sternberg type were scattered throughout. There were a number of areas of necrobiosis and slight fibrosis. Superimposed polynuclear exudate was present in the more degenerated areas. The entire structure was one of granuloma with abundant histocytes and Reed-Sternberg cells.

Postoperatively the temperature curve remained the same. The wound healed per primum. She received daily doses of arsenic parenterally. She was given transfusions every fourth or fifth day. On July 23, the abdomen was divided into quadrants and she was daily subjected to roentgen therapy for thirteen days; the patient at this time was too weak and the therapy was discontinued. On August 7, the patient had two bloody bowel movements. On August 8 she had another bloody bowel movement. On August 14, her temperature

rose to 105°F. and the patient expired on the forty-ninth postoperative day.

COMMENTS

1. The illness of this patient was a diagnostic puzzle from the beginning. Perhaps by a process of elimination, the diagnosis could have been made.

2. In abdominal Hodgkin's disease, in the absence of enlargement of the superficial nodes, a small spleen and no leading symptoms, one doubts whether the diagnosis could have been made.

3. During the short interval prior to the operation considerable work was done; further study was abandoned because the patient was rapidly going downhill, and in the presence of a mass in the left upper and middle quadrants, an immediate exploratory was decided upon.

4. The diarrhea and the pigmentation on the face were not advantageously evaluated.

5. The pyrexia (never of the Pel-Ebstein type), the malignant course (with the patient losing seventy pounds in seven months), the extensive pathological involvement, leads one to classify this case as a malignant Hodgkin's sarcoma.

6. Forty days after the operation, the patient had bloody stools on several occasions, leading us to believe that further intestinal involvement had taken place in proximity to the anastomosis.

7. Following the high voltage roentgen therapy there was neither subjective nor objective improvement. Perhaps the treatment was instituted too late.

8. This case maintained an elevated pulse rate, completely out of proportion to the temperature, which according to L. Goldman in a series of 212 cases, is a striking feature.

9. In this advanced type of Hodgkin's disease with numerous glands in the mesentery, surprisingly, the spleen remained small There was neither eosinophilia present nor pruritus.

10. The sedimentation rate in this case repeated several times maintained an average of 14 to 16 instead of a higher sedimentation curve which one would expect in this advanced type of Hodgkin's disease, perhaps influenced by the transfusions.

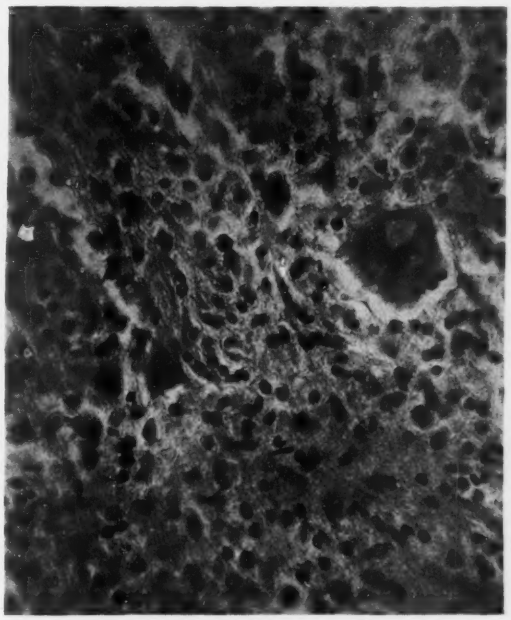


Fig. 6. Photomicrograph of the tissue showing multinuclear giant cells.

11. The secondary cause of death here must have been terminal exhaustion, anemia and the pyrexia which had been present for four months.

CONCLUSION

This case had several diagnostic symptoms which although not pathognomonic were very suggestive of Hodgkin's disease: the prolonged diarrhea without a specific cause, the marked asthenia from the beginning of her illness, loss of weight, anemia, pyrexia, abdominal pain, elevation of her pulse out of proportion to the temperature and pigmentation (though localized on the face). When all these facts are correlated with the pathological findings and evaluated, the picture of Hodgkin's disease would stand out more prominently.

Through the courtesy of the Second Surgical Division of Morrisania City Hospital, headed by Dr. Peter T. Daly, the above case report is offered.

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IT is a well-known observation that, after parathyroidectomy, both in animals and in man, the hair may fall out in large amounts over a period of some months. The reason is not clear but it has been suggested that it is connected with disturbances of mineral metabolism.
From "Symptoms in Diagnosis" by Jonathan Campbell Meakins (Little, Brown and Company).

CARCINOMA OF BARTHOLIN'S GLAND

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CARCINOMA of Bartholin's gland is very rare and probably has often been a missed diagnosis. The earliest reference to a malignancy of this gland was made by Klob in 1864. In his book on the pathological anatomy of the female sex organs he mentioned, in connection with chronic inflammation of Bartholin's gland, a tumor formation which he described as resembling a cystosarcoma of the breast. He thought that this malignancy resulted from the chronic inflammation. In this same book, cysts of Bartholin's gland and carcinoma of the vulva are discussed separately with reference to the earlier literature but a definite, indisputable carcinoma of Bartholin's gland is not described. Since that time occasional reports of one to three cases have appeared. Several authors, especially the German and English, have also reviewed the literature, collected the known cases, summarized the data and incidentally have provided extensive bibliographies. The most complete and most valuable of these studies have been made by Honan (1897), Sitzenfrey (1906), Spencer (1914), Wittkopf (1915), Falls (1923), Harer (1933), Rabson and Meeker (1938), Gobel (1938) and Simendinger (1939).

The exact incidence of this tumor is difficult to determine. Many of the reported cases, especially the earlier ones, are incomplete and the details essential for verification of their diagnosis are lacking. It is also obvious that many of these cases are reported as carcinomas of the vulva rather than of Bartholin's gland because they are seen too late and when the growth is too extensive to permit determination of their exact origins. Another factor which contributes to the uncertainty as to the actual incidence of this tumor is the possible total lack of diagnosis in early cases removed without subsequent laboratory study. This possibility is suggested by the fact that, in many reported cases, the true nature of the lesion was discovered only at operation or when the material was examined by a pathologist. Unless all cysts and abscesses of Bartholin's glands are made the subject of careful pathologic study, the incidence of its carcinoma in its early stages will be uncertain. Rabson and Meeker, in 1938, reported a collection of fifty-six cases from the world literature and added two of their own. In the same year, Göbel collected fifty cases and added three. In May, of 1939, Simendinger added eighteen cases to a list of twenty made in 1923 by Falls. These two authors attempted to list only the bona fide cases and to give comparative data as regards age of patient, type of tumor found, metastases, treatment and results. Simendinger had four cases, including his own, which Rabson and Meeker had not reported. In November, of 1940, Cosbie reported one additional case which was included in his study of fifty-nine cases of vulvar carcinoma. In this same month, Taussig published a report of his experience with 155 cases of vulvar carcinoma, nine of which originated in Bartholin's gland. It is evident that although there are about seventy-five cases reported in the literature, a great number of these are published with inadequate data and may not be accepted as proved cases of Bartholin gland carcinoma.

This infrequent occurrence of Bartholin gland carcinoma is also reflected in textbooks and treatises on gynecology where it is usually mentioned in connection with the discussion of carcinoma of the vulva. It is given the same course and the same

bad prognosis which would be expected when it is so often seen only in its advanced stages after the skin of the vulva has been involved. But this tumor is worthy of separate consideration, at least in regard to its early diagnosis and prognosis. Although Bartholin's gland is a part of the vulva, it is a distinct encapsulated structure having a well developed stroma. It gives rise to a carcinoma which, in its early stages especially before the capsule is penetrated, would be expected to give a greater hope for cure than that of the vulva where a malignancy so often arises on an already altered epithelium (as in leukoplakia) and may be multicentric. The data published do not prove this to be true; but in view of the fact that so many of the cases are seen after the patient has realized a lump in the labium for a period of six months or several years, or, as in a few cases, the lesion has been treated unsuccessfully as a Bartholin's abscess, including incision and drainage of necrotic tissue, there is reason to ask whether these might not permit a hopeful prognosis if completely removed and diagnosed early.

Fig. 1. Low power of a section of a Bartholin's gland showing chronic inflammation with squamous cell replacement of its columnar epithelium.

Honan, in 1897, suggested criteria for the diagnosis of Bartholin's gland carcinoma and reference to these is repeatedly made in the literature. He suggested the diagnosis whenever there is a tumor mass in the typical site of Bartholin's gland, a tumor deep in the labium especially if the overlying skin is intact, a tumor having a microscopic picture bearing some resemblance to the normal gland epithelium and the presence within the tumor of normal gland tissue or its connection with the gland duct. Clinically, it can be suspected with the presence of a lump in the region of Bartholin's gland, i.e., the posterior third of the labium majus. The lump is usually reported as hard, sometimes nodular, sometimes freely movable or sometimes bound to adjacent structures. If there is necrosis of tissue the tumor may appear to be cystic or soft and this is the condition which leads to its treatment for abscess with a diagnosis of carcinoma after the lesion has been incised and fails to heal. In the early stages there are usually no subjective

Fig. 2. High power of the same section showing detail of stratified squamous epithelium replacing the columnar epithelium of the gland ducts.

symptoms and neither the patient nor the physician is impressed with the seriousness of the situation. Taussig advised close observation or complete excision of enlarged Bartholin's glands in all women over forty years of age.

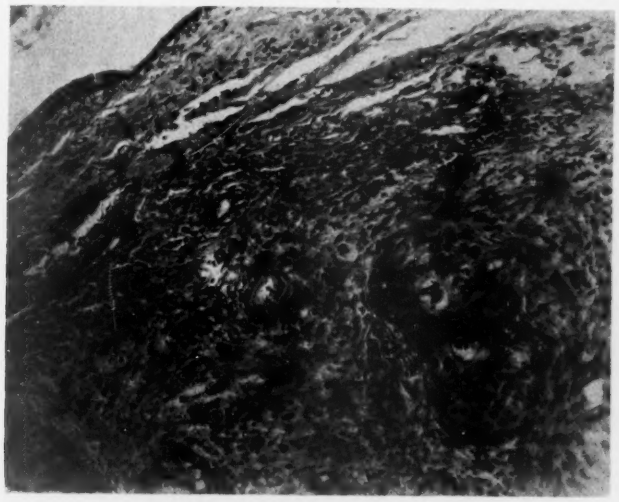

Fig. 3. Squamous cell carcinoma of Bartholin's gland seen invading the wall of the duct. The duct wall is shown in the upper left corner of the photograph.

The normal epithelium of this gland has been repeatedly described. It is generally agreed that columnar epithelium lines the alveoli and that in the ducts there is epithelium of a transitional type composed of cylindrical cells in many layers. This is quite characteristic of Bartholin's gland and is not simulated by any other gland structures of the labium. Stratified squamous epithelium is found normally only at the orifice and in the terminal portion of the main excretory duct, but in chronic inflammatory conditions of the gland, several authors have described the occurrence of this type of epithelium in the deeper parts. Sitzenfrey was the first to illustrate this condition and he was followed by Schweitzer who called it metaplasia. In the surgical specimens of our laboratory this phenomenon has been repeatedly observed. It presents itself as a replacement of the cylindrical or transitional epithelium by the stratified squamous type in the manner of that which takes place in chronic inflammation of the cervix uteri. (Figs. 1 and 2.) This condition makes possible the origin of either squamous cell or adenocarcinoma within the deeper portions of the gland.

Extensive search of the literature reveals no special study of the lymphatics which drain Bartholin's gland; they are generally considered to be the same as those from the vulva. After a detailed study of the lymph-nodes involved in cases of vulvar carcinoma, Taussig has divided them into five groups: the inguinofemoral group, those of the external iliacs, the obturator glands, the hypogastric glands and the ureteral glands. In sixty-five cases of vulvar carcinoma there were thirty with lymph-node metastases. The inguinofemoral chain was involved forty times, twenty-one times on the right and nineteen times on the left. In only five cases were the deeper glands involved, the right external iliacs twice, the right obturators once, the left external iliacs once and the left obturators once. The conclusion is drawn that most metastases from vulvar carcinomas occur in the inguinofemoral chains on either or both sides and that rarely is there a metastasis into the deeper nodes. The application of this information to the lymphatic spread of Bartholin's gland carcinomas is open to question, especially those arising in the deeper portions of that structure.

The therapy advised for Bartholin's gland carcinoma is varied as would be expected when few surgeons have had experience with more than one to three cases. In most cases reported there is a tendency to do a radical excision with removal of the inguinofemoral glands of both sides because of the lymphatic anastomosis in the mons veneris. Few attempt to remove the deeper nodes because if these are involved the case is hopeless. Hunt and Powell discussed this therapy in their paper of 1926 and questioned the advisability of ever removing the lymph-nodes. Probably the only successful treatment is early, complete excision of the tumor.

It is because of the rarity of this tumor, the fact that if kept in mind its presence is readily suspected and because of the belief that if diagnosed and removed early there may be hope for its cure, that this report is written.

CASE REPORT

I. H., a white woman, age fifty-four, was admitted to Lancaster General Hospital on June 6, 1935, with the following complaints: swelling in the vagina and rectum, painful bowel movements and itching of the anus. Hemorrhoids had been noticed for two years. For several years the patient had realized that her vagina was getting smaller and for six to seven months she had noticed a swelling inside and beside the vagina and the rectum. There was slight pain on defecation. No bleeding had occurred but there was a slight vaginal discharge. Itching of the anus, which brought the patient to the physician, had persisted for three weeks. She had also suffered a weight loss of fifteen pounds in four to five weeks.

The past history was irrelevant except for chronic pelvic inflammatory disease of many years' duration and for which she was operated in 1925. At that time the Fallopian tubes which were bound down in the cul-de-sac were removed. A thorough pelvic examination then revealed no evidence of tumor.

On June 8, 1935, the patient was operated upon. A tumor which extended from the region of the vagina into the rectovaginal space and back into the ischiorectal space was removed. The overlying epithelium in both vagina and rectum was removed along with the tumor because of gross changes which made its involvement seem probable. An attempt to repair the pelvic floor and the anal sphincter was made. No enlargement of the inguinal nodes was found at that time.

The tumor was examined and its pathology reported by Dr. Louisa E. Keasbey of this hospital. The specimen weighed 67 Gm. and measured 6 by 4.5 by 4.5 cm. It appeared to be irregularly dissected from the surrounding tissue and did not seem to be completely removed. The mass was surmounted in one area by rectal mucosa which was not thickened and appeared grossly not to be the source of the tumor. Beneath the mucous membrane, the muscular coat of the rectum was identified but was incomplete. An area of vaginal mucosa was present and also appeared not to be involved by the tumor process. The tumor had a fibrous texture.

Microscopic examination showed broad sheets and masses of squamous cell carcinoma infiltrating a rather abundant fibromuscular stroma. The masses of tumor cells were exceedingly large and anastomosed with one another. They showed hornification. The differentiation between the periphery and the centers of these masses was ill defined and irregular. In the centers large areas of hyaline degeneration were found. The carcinoma cells varied markedly in size and shape. Those in the centers were large and round; the peripheral ones were smaller and fusiform. Many giant cells and b zarre nuclei were present. Mitotic figures averaged about 6 per 10 high power fields. The stroma showed little evidence of inflammation. The vaginal mucous membrane present was not involved and microscopically a broad band of fibrous tissue separated the tumor from the rectum. In certain areas the carcinoma surrounded an empty branching lumen as would a neoplasm spreading along the walls of a duct. The alveoli resembling those of Bartholin's glands were compressed and atrophic. They did not participate in the carcinomatous process. At the periphery of the carcinoma in certain sections, compressed tubules of the type seen in Bartholin's glands were found and the impression was gained that this tumor arose in the duct of Bartholin's gland.

The postoperative course was uneventful except for the fact that fecal incontinence

persisted and on July 24, a colostomy was done. The patient then made a good recovery and on August 8, 1935, she left the hospital wearing a colostomy bag which was functioning well.

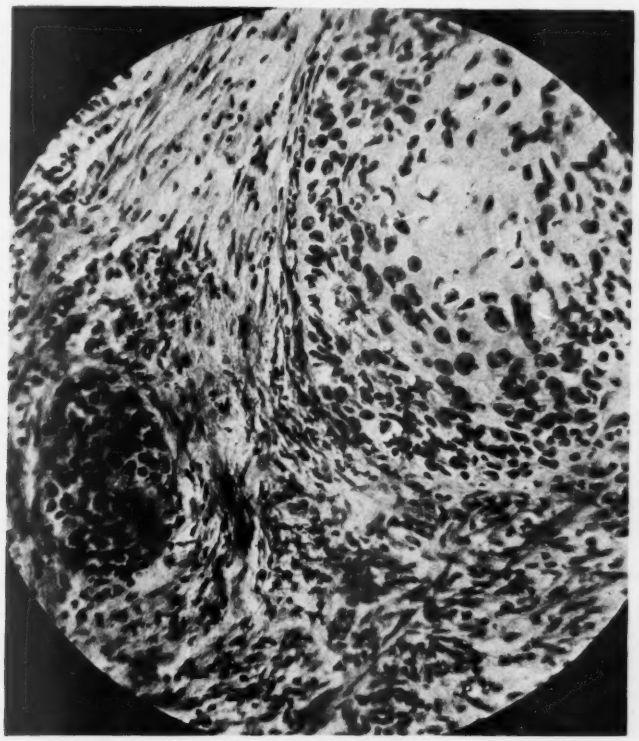

FIG. 4. High power field showing detail of the squamous cell carcinoma.

Postoperative deep *x*-ray therapy was begun on June 28 and continued until December 20. Four portals encircling the pelvis were used with the following factors: 20 K.V. and filters of 0.5 mm. copper with 2 mm. aluminum at a distance of 50 cm. The portals each measured 15 by 15 cm.

On June 26, 1937, the patient returned with pain in the right hip. There was no history of trauma. The pain had started four weeks previously and had become progressively worse until she was unable to walk. *X*-ray showed a fracture of the neck of the femur without displacement. Considering the possibility of a pathological fracture following metastasis an *x*-ray examination of the lumbar spine, the entire pelvis and both femora was made. No evidence of tumor was found. With proper treatment the patient recovered and returned to her former state of good health.

On November 11, 1939, the patient returned again. She had been very well until about three weeks previously when she began to notice blood in her urine. She appeared to be in good condition and the colostomy bag was functioning satisfactorily. Cystoscopic examination showed a severe inflammation of the bladder which was treated.

On August 16, 1940, she returned complaining of bleeding from the rectum. There was slight bleeding from the distal loop of bowel after irrigation. On physical examination she was found to be fairly well nourished and suffered no discomfort. Both abdominal and anal stomas were too strictured to admit the examining finger. Vaginal examination showed a firm mass about the size of a peach in the rectovaginal septum and the perineum with some induration forward around the vaginal introitus on the right side. The induration was possibly scar from the original resection but the main mass seemed probably to be a local recurrence of the tumor. No evidence of distant metastasis was found. On August 29, 1940, an abdominoperineal resection of the rectum and sigmoid with the entire posterior vaginal wall was done. The wide wound was repaired as much as possible.

Examination of the tissue removed at operation showed a squamous cell carcinoma resembling that which was first removed except

for the presence of much more pleomorphism and a scanty amount of stroma. It extended to the mucous membrane of the rectum and the vagina.

Postoperatively the patient reacted well and progressed satisfactorily until September 24 when she began to have a high fever and blood in her urine. This condition persisted in spite of treatment. She failed gradually and expired on November 9, 1940.

Autopsy was performed on the day of death. There was evidence of marked weight loss. The sigmoidostomy wound was intact but was associated with a small sinus tract that extended into the subcutaneous tissue of the abdominal wall. The perineal wound appeared clean and its granulation tissue bled easily. There was a patchy pneumonia especially marked in the right lung. The peritoneal cavity was clean but a pyelonephritis was found. This was more marked in the right kidney where the urine seen in the pelvis was frankly purulent. A thorough search grossly and microscopically was made of the pelvic and inguinal lymph-nodes and no evidence of tumor metastasis was found. Sections were made of the wound edge looking for areas of tumor tissue and none were found.

CONCLUSIONS

1. Carcinoma of Bartholin's gland is rare if its incidence is judged by the number of cases reported. Its exact incidence is uncertain because of the fact that many cases are reported as carcinoma of the vulva without discrimination as to definite origin, and that many cases are reported as carcinoma of Bartholin's gland without adequate data to prove this fact.

2. The prognosis, according to the literature in which it is often classed as a carcinoma of the vulva, is poor. However, a study of its distinct anatomic structure and a consideration of the fact that many cases are seen when the lesion is far advanced suggests that the prognosis might be more hopeful. A review of the case reported in this paper supports the more favorable prognosis in that this tumor, although seen after a duration of several years, showed no metastases in over five years following its excision.

3. No study of the lymphatic drainage of Bartholin's gland, distinct from that of the vulva, is found. Carcinoma of the vulva is reported to have involved the regional lymph-nodes in less than half of the cases and then usually the inguinofemoral chains. The application of this information to lymph drainage from carcinoma of Bartholin's gland is probably open to question.

4. If kept in mind, the presence of this tumor may easily be suspected in its early stages with hope that prompt complete excision may affect a permanent cure.

I wish to express my appreciation and thanks to Dr. S. G. Pontius and Dr. Ross Proctor for the use of their clinical data of this case.

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SUCCESSFUL PRIMARY REPAIR OF LACERATED PAROTID DUCT

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ALTHOUGH laceration of the parotid duct is not a very common occurrence in peace time, it may become relatively frequent during the course of the present war. This expected increase in frequency brings the necessity for the proper care of such wounds into prominence. This is particularly true when we remember the high incidence of development of external fistulas in mismanaged cases and the prolonged morbidity which results from such complications.

In reviewing the literature, we find that only five successful repairs have been reported. It is perhaps significant to note that the first case was reported by Dr. Tees[1] in 1926. He used catgut as a dowel in the duct and left the end projecting in the mouth. He then approximated the ends of the duct with two fine interrupted catgut sutures passed through the sheath around the duct. In 1927, Dickinson[2] used the same technic but used silkworm gut for a dowel. He fixed it in the buccal mucosa by a suture. However, the suture fell out in two days. Black and Flagge,[3] in 1928, used a small ureteral catheter as a dowel and left one inch projecting into the mouth, and fixed it by interrupted linen sutures around the opening of the duct. The catheter was removed on the ninth postoperative day. Brohm and Bird,[4] in 1935, used a filiform ureteral bougie as a dowel. They passed the distal end of the bougie through the cheek and sutured it to the skin at the point of exit. In 1933, Butler and Guinan[5] reported a successful repair forty-one days after the injury. They used a ureteral catheter as a dowel and anchored the distal end to the upper canine tooth with a silk ligature. This arrangement allowed slight motion of the catheter in the duct when the lower jaw moved. Butler believes that this motion is advantageous. We, however, believe that such an arrangement is injurious because of the trauma to the delicate mucosa of the duct produced by the motion. This is confirmed by the fact that the authors were forced to remove the catheter on the third postoperative day because of the swelling.

It is perhaps interesting to note, that with slight variation all of these men used the same technic for the repair of the duct. However, there was diversion of opinion as to the type of dowel and the method of fixation used, most of which required special instruments. In our case, we used a very simple method which can be easily adapted to army conditions. This was done in our minor surgery room with morphine sulfate and scopalamine the only anesthetic used.

CASE REPORT

A. C., a twenty-seven year old colored female, was in an auto accident and was admitted to the hospital on January 16, 1942, five and one-half hours after the accident. She received several lacerations and abrasions of the face. The most prominent laceration was one midway between the right angle of the mouth and the tragus of the right ear. It was about five inches long and extended from the inferior angle of the mandible straight upward. The parotid duct, the branches of the facial nerve and the masseter muscle were severed. The wound was cleansed with green soap and

water, irrigated with saline and débrided very carefully. The severed nerve fibers were too small to warrant repair. The cut ends of the parotid duct were then easily identified.

Repair. One end of a horsehair suture was placed in the lumen of the proximal end of the severed duct for a distance of about one inch and the other end of the horsehair was passed through the lumen of the distal end of the duct into the mouth. This was used as a dowel. The ends of the duct were then approximated by interrupted black silk sutures passed through the sheath around the duct. The wound was then closed in layers using No. 0 interrupted catgut for the deeper tissues and interrupted black silk for the skin. The fixation of the dowel was accomplished by taping it with adhesive tape to the skin of the angle of the mouth.

The postoperative course was uneventful. On the second postoperative day, salivary secretion was seen flowing from the parotid duct opening into the mouth. The dowel was removed on the seventh postoperative day and the patient was sent home on the ninth postoperative day and was referred to the Follow-Up Clinic, where she was seen at weekly intervals at first then once every two weeks. On the eightieth postoperative day, the patient was seen in the clinic. The wound was well healed with no induration and no evidence of the formation of a fistula. There was a normal salivary secretion on the affected side.

CONCLUSION

A case of traumatic laceration of the parotid duct with successful primary repair is described. We wish to emphasize what we believe are some of the important features in the management of these cases: The first essential is to transform a contaminated wound into a clean wound by thoroughly and gently cleansing with soap and water using cotton pledgets followed with saline irrigations. The ends of the duct must be carefully identified and handled gently so as to avoid further damage to the delicate wall. Then a horsehair dowel about six inches long is placed through each end of the duct so that it enters the proximal end about one inch, and allows the distal end to protrude through the mouth. The two ends of the duct are then approximated by one layer of interrupted silk sutures, placing the stitches through the outer sheath only. We advise the use of silk or any other equivalent nonabsorbable suture material, because the wounds heal by the so-called "dry healing" with a minimum amount of tissue reaction and there is lessening of subsequent stricture of the lumen of the duct. The dowel is best left *in situ* for at least seven days, since its function is merely to maintain patency and approximation of the lumen and to allow the secretions to pass between it and the duct wall. After seven days, its removel can be safely accomplished. It is essential that oral hygiene be maintained throughout the healing process, if secondary infection and parotitis are to be avoided.

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SURGICAL CONSIDERATION OF THE INGUINAL TRIANGLES

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OVER the years much has been written about the anatomy and surgery of the inguinal region, so much so that seemingly there is nothing more to be said. However, occasionally the miner, on going over his old washings finds a nugget that he missed the first time. It is the purpose of this paper to call attention to two anatomical facts of this inguinal area, which if made use of will improve the operative results for repair of defects or deformities of this region.

Most instructors of anatomy teach the anatomy of the inguinal region as seen from the front which presents the abdominal wall anteriorally and ending at Poupart's ligament inferiorally. If one views the abdominal wall from within outward and along the lines of force which the abdominal contents exert on this region when the body is in the upright position, one gets a different picture. In this view it will be seen that Poupart's ligament is only an angle in the abdominal curve, the wall actually ending along the superior ramus of the pubis. Viewed from the side Poupart's ligament is the fascial band forming an obtuse angle with the abdominal wall and the superior ramus of the pubis. In planning for the repair of a hernia, the approach, at least mentally, should be from the inside and above Poupart's ligament at the origin of the trouble and not from the outside where one sees only the results of the internal pressure. The proper way to repair a hole in the dike is from the inside and not the outside.

Again viewing the abdominal wall from the inside (Fig. 1), one can see three triangles, one complete, the other two incomplete. The larger triangle which lies above Poupart's ligament is bounded medially by the obliterated umbilical veins, inferiorly by Poupart's ligament and laterally by the inferior epigastric vessels which traverse the subperitoneal space toward the tip of the uracus to join the medial side of the triangle.

Below Poupart's ligament there is a long narrow triangle with the base along the spine and ramus of the pubis; the apex at the inferior iliac spine and the sides being made up by the superior ramus of the pubis and Poupart's ligament. The triangle is filled by the iliapsoas muscle and the femoral nerve, artery and vein from out inward, respectively, except for a space about one inch long at the base. This space is normally filled with fat. This is the outlet through which a femoral hernia passes.

Crossing over Poupart's ligament in about its middle portion and lateral to the epigastric vessels is a cord-like structure, the vas deferens in the male and round ligament in the female, the former arising from the base of the bladder and the latter from the uterus, forming an acute angle about the inferior epigastric vessels and desending along Poupart's ligament (in the inguinal canal). It will be seen that the vas deferens or round ligament form a third triangle when viewed from the inside.

If one palpates forcibly against the abdominal wall, three areas will be felt: (1) the internal ring at the agress of the vas deferens in the male or the round ligament in the female, this being the site of an indirect hernia; (2) the base of triangle A, the site of a direct hernia; (3) at the base of triangle B, the site of a femoral hernia. These weak spots are all actually quite close together and in the cadaver can be

palpated by the thumb, index and middle fingers in apposition.

In the cadaver if one examines along the

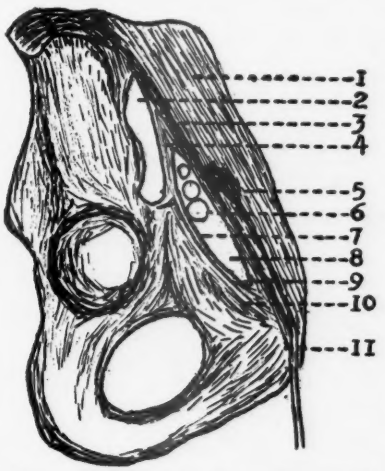

Fig. 1. Structures about Poupart's ligament: (1) External oblique muscle and fascia; (2) lacuna exit of iliopsoas muscle; (3) Poupart's ligament; (4) iliopsoas fascia and septum; (5) internal inguinal ring; (6) femoral nerve, artery and vein; (7) upper portion of Cooper's ligament; (8) empty space, site of femoral hernia; (9) lower end of Cooper's ligament; (10) superior ramus of pubis; (11) vas deferens, pulled medially. Normally it takes a fairly direct course from the base of the bladder to the internal inguinal ring.

superior ramus of the pubis, the one side of triangle B, a well formed band of fascial tissue, Cooper's ligament, will be easily found. The function of this ligament is not definitely known but it has comparatively great strength. By passing a stout ribbon around it, the cadaver may be suspended by this structure alone. Poupart's ligament can be torn with much less force. Cooper's ligament seemingly was just placed in this position to facilitate a strong anatomical hernia repair.

PRACTICAL APPLICATION

In the repair of hernia, regardless if it be indirect, direct inguinal or femoral, it should be the surgeons endeavor to eliminate all three of these weak spots, not just one, to guard against another hernia in this region. The basis of most hernia repair is the suturing of the conjoined tendon, or reflected ligament, to the shelving edge of Poupart's ligament. This is

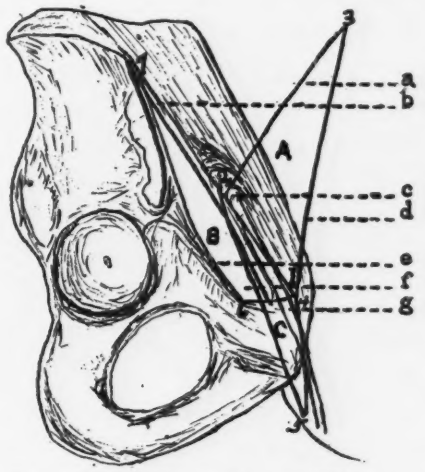

Fig. 2. Inguinal triangles semidiagrammatic: (1) Triangle A, 1, 2, 3, 1, 2–3 (*a*) superficial epigastric vessels; 1–2 (*c*) Poupart's ligament, lower half; 3–1 (*d*) obliterated hypogastric vessels. (2) Triangle B, 1, 6, 7, 1, 1–7 (*b*) Poupart's ligament; 1–6 (*e*) Cooper's ligament, lower portion; 6–7 (*e*) Cooper's ligament, upper portion and fascia and septum over iliapsoas muscle. (3) Triangle C, 5, 2, 1, 5, 2–1 (*c*) Poupart's ligament, lower half; 4–5 (*d*) obliterated hypogastric vessels; 5–2 (*g*) vas deferens.

anatomically and physiologically wrong. Anatomically, it closes only two of the weak spots. Though it occurs infrequently, most surgeons of considerable experience can recall cases in which an inguinal hernia had been repaired, the patient returned at a later date with a femoral hernia or vice versa. Physiologically, the surgeon knows that Poupart's ligament is considerably weakened, especially when fascial sutures are used by suturing into this structure. The fibers of this structure run longitudinally. Tension and sutures tear them apart. In the repair, if, the transversalis fascia is opened at the level of Poupart's ligament and the peritoneum held medially with a retractor, it is quite easy to drop down and pick up Cooper's ligament, suturing the conjoin tendon to this strong structure. (Fig. 3.) This may be likened to pulling the curtain clear to the base of the

window instead of only half way for an effective black-out. It is suggested that fascial or nonabsorbable sutures be used here. The remainder of the operation may be completed according to the surgeon's particular fancy. It will be noted that the reflected portion of Poupart's ligament, at least in its proximal end, can be imbricated over part of the conjoin tendon and the external oblique imbricated over this, if so desired.

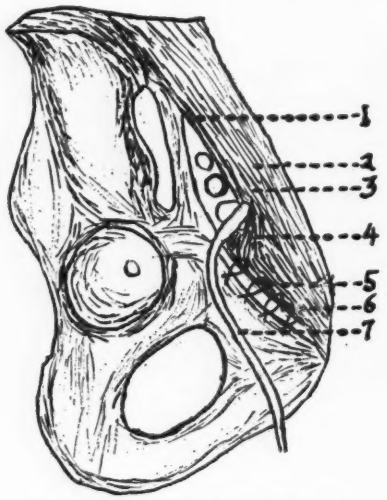

Fig. 3. Repair of hernia with suture of conjoin tendon to Cooper's ligament (diagrammatic). (1) Poupart's ligament, upper portion; (2) external oblique fascia and muscle; (3) internal inguinal ring; (4) conjoined tendon sutured to Cooper's ligament; (5) sutures uniting the conjoin tendon to Cooper's ligament; (6) Cooper's ligament; (7) vas deferens.

This procedure is applicable to all three types of hernias, eliminating the potential femoral hernia space also facilitating imbrication, and it furnishes a more secure anchorage for the key stitches.

CRYPTORCHIDISM

In the surgical treatment for the cure of the undescended testes, the difficult procedure is to get sufficient length to the cord to allow the testes to be placed in the scrotum without undue tension. A glance at triangle C in Figures 1 and 4 shows that the vas deferens traverses two sides of the triangle i.e., 5, 6 and 1. The shortest distance is from 1 to 3 thereby actually giving from one and a half to two inches more mobility to the vas and the cord.

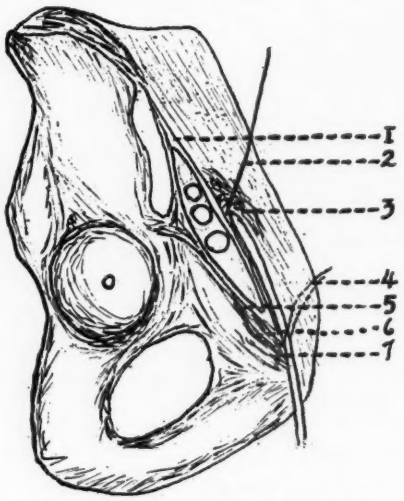

Fig. 4. Proposed "short cut" for course of vas deferens in orchidopexy: (1) Poupart's ligament; (2) superficial epigastric vessels; (3) internal inguinal ring; (4) vas deferens transplanted directly forward; (5) Cooper's ligament; (6) superior ramus of pubis; (7) vas deferens.

This may be accomplished by cutting and ligating the inferior epigastric vessels or better by passing the testes behind these vessels. In performing this procedure, if a hernia is present, it is advisable not to open the hernial sac, using this as a tractor, swinging the testes behind and medially, repairing the hernia as a last step before closure. The vas and cord usually get part of their blood supply from a branch of the inferior epigastric vessels. If possible this should be preserved but may be ligated if the spermatic artery has not been injured. The vas deferens can now be mobilized subperitoneally down to the origin at the base of the bladder. Great care should be exercised to preserve the blood vessels of the cord as ligation of the spermatic artery will result in atrophy of the testes. As noted in Figures 1 and 4 the vas deferens and cord now lie in a new route, i.e., a direct loop from the base of the bladder up over the medial end of

Poupart's ligament and down into the scrotum.

SUMMARY

A three triangle conception of the inguinal region is presented with the purpose of clarifying some of the vague and easily forgotten anatomical facts of this region. Based upon this conception and facts an appeal is made for the surgeon to do a complete herniorraphy at the time of the first operation rather than a partial one. Also an anatomically correct step is given which if used will aid the surgeon materially in percurring sufficient cord length in orchidopexy to enable him to place the testes in the scrotum without undue tension. The author claims no originality in these two procedures as they have been described and used for some time but it is his belief that their value is not generally understood nor made use of.

One of the characteristics of the vomiting of obstruction, as distinguished from other acute abdominal lesions, is that it tends to be more frequent and abundant. The rationale of this occurrence is readily apparent in the existence of a mechanical block in the bowel, which brings about a regurgitation of the stagnant intestinal content into the higher reaches of the alimentary canal. When accumulation occurs in the stomach, vomiting is copious usually.

From "Intestinal Obstructions" by Owen H. Wagensteen, Second Edition (Charles C. Thomas).

LEFT THORACO-ABDOMINAL STAB WOUNDS

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THREE interesting and similar stab wounds of the left chest were admitted to the service of Erlanger Hospital in the year 1936.

CASE REPORTS

CASE I. An obese, white, male, age twenty-six, was seen in the emergency room thirty minutes after being stabbed. He was pale but conscious and coherent in speech. There was a four inch knife slash from the right eye to the midcheek. The respirations were 28 per minute and the pulse rate, 124. The blood pressure was 94 systolic and 62 diastolic. The left side of the chest was immobile and there was a three-inch wound in the anterior axillary line, between the ninth and tenth ribs, plugged with omentum. The left side of the chest was hyperresonant and there was an absence of breath sounds. The right border of the heart was 1 cm. to the right of the sternum. The heart sounds were distant but regular. The patient was given morphine and coramine in the emergency room and sent to the operating corridor.

Under intravenous evipal anesthesia, the chest wound was extended into the left upper quadrant of the abdomen for about four inches. The cartilaginous connection between the ninth and tenth ribs had been severed. Exploration of the spleen showed a 0.5 cm. wound which did not completely penetrate the capsule on the anterosuperior surface. The other viscera were not disturbed. The herniated portion of the omentum, which extended through the diaphragm, was amputated. There was complete collapse of the left lung but no bleeding. The incision in the diaphragm was three inches long and was closed with mattress sutures of heavy linen. The intercostal and abdominal muscles were closed with chromic catgut and the skin with dermal sutures. Four hundred cc. of air was aspirated from the left pleural cavity after closing the chest wound and 300 cc. aspirated on the second, fourth and sixth postoperative days. On the twenty-second postoperative day the patient was dismissed to the police. Ten days later, an *x*-ray of the chest showed no pathological condition of the lung or diaphragm. The wound was firmly healed.

CASE II. A thirty-year old, male negro was seen in an emergency room about forty minutes after a friend cut him up. There were several superficial lacerations and from an immobile left chest a portion of omentum extended in the posterior axillary line between the ninth and tenth ribs. The left chest was hyperresonant and no breath sounds were audible. The heart was at the right side of the sternum and the sounds were weak but regular. The blood pressure was 90 systolic and 52 diastolic. Ten per cent glucose was given intravenously and coramine and caffeine intramuscularly. The patient was sent to the operating corridor.

Under intravenous evipal anesthesia, the extended omentum was slightly withdrawn, amputated, and held in the opening. Five and a half inch sections of the ninth and tenth ribs were removed, paralleling the wound and the pleural cavity opened. Blood clots were removed and blood aspirated. A three-inch laceration of the diaphragm was elongated for one inch, retracted and the left upper quadrant of the abdomen explored. The spleen had been completely perforated by the knife and was bleeding. There was no other visceral injury apparent. The spleen was removed through the diaphragm incision with perfect control of the vessels. The blood clots were removed from the upper quadrant and the diaphragm sutured. Two plain catgut stitches were inserted in a laceration of the left lower lobe of the lung. The chest wall was closed without drainage. Air and a moderate amount of serosanguineous fluid was aspirated intermittently from the chest until the patient was dismissed to the police on the nineteenth day and lost to hospital records.

It is interesting that the patient showed no blood changes other than a relatively high recuperative red cell count (3,680,000 to 4,520,000) during his hospitalization on a high caloric diet. Red blood cell increase and microscopic cell changes have been reported follow-

ing removal of traumatic spleens. There were no changes in this case.

Case III. A twenty-two year old, male negro was seen in the emergency room with omentum protruding from a stab wound in the left anterior axillary line between the seventh and eighth ribs, about forty minutes after being stabbed. The left side of the chest was immobile, hyperresonant and breath sounds were absent except at the apex where they were diminished. The heart was displaced slightly to the right of the sternum but the sounds were of good quality, the rate 84 per minute, and the blood pressure 110 systolic and 80 diastolic. The left upper quadrant of the abdomen was tender and the muscles spastic. The patient was given morphine for pain and sent to the operating corridor.

Under ethylene anesthesia, the protruding omentum was cleansed, slightly withdrawn, clamped and the outer portion removed. Sections of the seventh and eighth ribs, approximately five inches long and paralleling the wound, were removed and the pleural cavity opened throughout the length of the incision. Pressure anesthesia had partially expanded the lung, but a two and one-half inch lacreation of the diaphragm was plugged with omentum. The protruding omentum was amputated and the abdomen explored by retracting the diaphragm wound. The stomach presented a one and one-half inch wound on its anterior aspect near the lesser curvature. The stomach was partially elevated into the pleural cavity and repaired with Lembert sutures. In the pleural cavity, some of the stomach's contents was expelled and this, together with blood clots, was washed out with normal saline solution. Blood clots were removed from the left upper quadrant. The diaphragm was closed with mattress sutures of chromic catgut. A small laceration in the lower lobe of the left lung was sutured and the chest wall closed. A soft rubber drain was inserted beneath the skin wound.

The postoperative convalescence was uneventful except for superficial wound infection and the patient was dismissed on the twenty-third postoperative day, after a negative *x*-ray examination and a completely healed wound.

The above emergency cases required immediate surgery. From examination, the weapons had penetrated into the abdomen through the thorax. With a pneumothorax and cardiac embarrassment, supportive emergency room measures are usually necessary.

The type of anesthesia is important. A lung is collapsed. The patient is still partially shocked from sudden anoxemia and cardiac shift. Should intratracheal or any form of pressure anesthesia be used, re-expansion of the lung and perhaps bleeding may take place. On the other hand, a deoxygenated victim may need cardiopulmonary support. In these cases of thoracotomys intravenous anesthesia and oxygen inhalation as indicated may be used. However, carefully controlled intratracheal anesthesia is preferable.

Surgical literature is prolific with reports of diaphragmatic hernias following wounds and injuries, (Christie,[1] Crook,[2] Harrington,[3] Hedblom,[4] Johnson[5]) but surprisingly little has been written on the immediate care of thoraco-abdominal wounds. Neugebaur[6] reports five cases (three gunshot and two stab wounds) which were operated upon within a few hours after their inception. The author used abdominal incisions and then extended the incision through the costochondral cartilage to explore the chest. Greene[7] reported six cases of stab wounds of the chest which extended through the diaphragm into the abdomen and were operated upon immediately. Two deaths occurred. In the first five cases, the writer explored the abdomen and then did a thoracotomy at the stab entrance. The sixth case was completed by the thoracic route alone.

The question of approach to a combined chest and abdominal wound is important. Lilienthal[8] sagely states that the site of the incision should depend on the location of the greatest amount of difficulty, either abdominal or thoracic, and that the individual case must be judged and no empirical rule can be followed. However, for a stab wound operated upon early, the direct thoracic approach offers some decided advantages for: (1) the lung is collapsed so that an adequate examination

of that organ can be made and the pleural cavity cleansed. (2) Exposure of the diaphragmatic wound is perfect. (3) Retraction of the diaphragmatic wound, and enlargement if necessary, brings immediately into view the viscus and abdominal area involved. Should there be indication for abdominal drainage, this may be done through small wounds in the abdominal wall directly to the involved site. (4) Early diaphragm repair avoids subsequent diaphragm operations which have a high mortality. (5) Chest wall closure is simple and, thanks to rapidly regenerating pericostal rib formation, a firm body wall maintained. Lung collapse is easily handled by aspiration as indicated.

CONCLUSIONS

1. In thoraco-abdominal stab wounds, immediate operation after shock is indicated.

2. Intravenous anesthesia and oxygen when necessary may be used although intratracheal is preferred.

3. Direct, transthoracic and transdiaphragmatic approach to the site of a thoraco-abdominal injury is advocated.

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PRIMARY LYMPHOSARCOMA OF THE INTESTINE IN A BOY OF SEVEN

FOLLOW-UP OF NINE YEARS

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IN the January, 1935, issue of *The Americal Journal of Surgery*, a case of lymphosarcoma of the small intestine in a boy of seven was reported by the author. The rarity of the condition was discussed and 375 cases of lymphosarcoma of the intestine were found in the literature up to that time. Twenty-nine additional cases have been reported since, making a total of 404 cases.

CASE REPORT

The boy (F. P. No. 41916) was admitted to the Brooklyn Cancer Institute on December 4, 1933. Three weeks previous to admission to our Institution, he had been treated in the clinic of another hospital for a cold. During a routine examination a palpable tumor was found in the lower part of the abdomen. After a complete work-up, a gastrointestinal series revealed "some pathology connected with the small intestine, which did not appear to obstruct, but showed dilatation or distortion of the gut." An exploratory laparotomy performed by Dr. Dexter B. Davis revealed a freely movable tumor of the lower third of the ileum, measuring about three and one-half inches in diameter, and enlarged glands at the root of the mesentery. The tumor and about two inches of normal gut on either side were resected, followed by a lateral anastomosis. The pathological report of the tumor by Dr. James W. Denton was lymphosarcoma of the ileum. The diagnosis was later confirmed at our Institution.

A photograph of the patient, the resected segment of the intestine, and microphotograph of the tumor were included in the original article in 1935.

The patient received postoperative *x*-ray therapy at the Brooklyn Cancer Institute, where he has been followed in our clinic up to the present writing. Repeated roentgen examination of the lungs and gastrointestinal tract have failed to reveal any recurrence or metastasis. The last gastrointestinal series was done in February, 1942. The patient is now sixteen years old, well developed, attending school, and has no symptoms. He is still being carefully followed at the Brooklyn Cancer Institute.

Of the 404 cases of lymphosarcoma of the intestine reported in the literature, 103 had careful follow-ups. Of these, only fourteen survived for five years or more (13.6 per cent). Eight patients lived from seven to eleven years. The average duration of life was 16.7 months.

MARCH FRACTURE AS A COMPLICATION OF PREGNANCY

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MARCH fracture, or March foot, was first described by Breithaupt,[1] a military surgeon, in 1855. He reported several cases of edematous and painful feet occurring in soldiers following long marches. He called it Fussgeschwulst and thought it was due to an inflammatory reaction of the tendon sheaths caused by trauma.

FIG. 1. Anteroposterior and oblique views of foot showing fracture of the distal half of the shaft of the second metatarsal with slight periosteal proliferation.

In subsequent years several other reports on this condition were made, but it was not until 1899 that Thiele[2] reported seventeen cases studied by the roentgen ray. Fifteen of these patients showed evidence of fracture of the metatarsals. There had been no history of trauma other than that produced by much walking while carrying heavy soldier's packs.

A detailed review of the literature will not be given as there have been several recent articles in which the previous reports have been thoroughly studied. Important among these is that of Meyerding and Pollock.[3]

Various theories of etiology have been advanced. Zeitlin and Odessky[4] stated that the fracture resulted from overloading a foot weakened functionally and anatomically. Jansen's[5] theory was that spasm of the interosseus muscles led to hypertrophy of the muscle tissue and periosteum. Subperiosteal hemorrhages followed and this resulted in partial absorption of the bone, with resulting increase in brittleness and susceptibility to fracture.

Because of the fact that the true nature of March fracture has not been generally known in the past, serious mistakes have been made in diagnosis and treatment. Dodd[6] reported a case in which amputation was performed through a mistaken idea that sarcoma was present. Strauss[7] reported

a case in which a previous diagnosis had been made of sarcoma and amputation of the leg advised. There had been no history of trauma and no fracture line could be seen. Investigation for lues was negative, so the entire second metatarsal was removed. Other conditions which must be ruled out are chronic foot strain and tenosynovitis. In the former there is rarely any swelling and the latter seldom affects foot tendons. Roentgen ray evidence of fracture effectively rules out these two conditions and clinches the diagnosis.

Fig. 2. Anteroposterior and oblique views of foot four weeks following application of cast, showing definite callus at the site of fracture of the shaft of the second metatarsal.

The condition has been described in people of both sexes and in different walks of life. Pain in the foot follows much walking or weight bearing. There is accompanying swelling and tenderness. Roentgen rays may, or may not, show evidence of a fracture of the metatarsal shafts. The second metatarsal is usually involved, but all of the others may, at times, be implicated.

Many forms of treatment have been advocated, the most common being rest in a plaster cast. At the end of three or four weeks another roentgenogram will show definite evidence of callus formation at the site of fracture.

A reasonably complete review of the available literature in English reveals no case in which the condition was found in a pregnant woman. The case I wish to report is one of this type. Such cases must have occurred before as the necessary predisposing causes are found in practically all pregnant women. All of them gain weight and the feet of modern women are ill adapted to carry their normal weight, let alone the extra weight of a fetus. Obstetricians now advise their patients to walk more than they would ordinarily, and this brings in the factor of excessive weight bearing.

CASE REPORT

Mrs. T. C., a white woman, aged thirty, was first seen on March 4, 1941. She was seven months pregnant at that time and had been doing much walking to keep her weight down, on the advice of her physician.

For the previous eight days she had had swelling and pain in the left foot. This was confined to the dorsum of the foot and there had been no injury. It was gradually becoming worse. She had never had anything like it before. The swelling did not go down during the night and there had been no redness or other discoloration. No other joints were involved. On the evening of examination she complained of pain in the left sacroiliac region, for the first time. She had used infra red light and warm salts baths without relief.

Examination of the left foot showed diffuse swelling of the dorsum of the foot proximal to the toes. There was marked tenderness of the distal ends of the second and third metatarsals. There was no redness or increased local heat. Dorsiflexion of the toes was painful but plantar flexion did not cause pain. The blood vessels were easily palpated.

A roentgenogram taken the same day revealed a faint shadow along each side of the distal third of the shaft of the second metatarsal associated with a fine line running part way through the bone. These changes were barely visible on close scrutiny and can be shown only faintly in the reproduction of the roentgenogram. (Fig. 1.)

A diagnosis of March fracture was made and a short leg cast was applied from the ends of the toes to below the knee. A walking iron was placed on the cast and after the cast became hard she was instructed to walk on it. The sacroiliac pain was undoubtedly due to the strain of walking on a painful foot.

A few days later she called on the telephone saying that her foot was quite comfortable and that she had no pain. Thereafter, she got along very well and after wearing the cast four weeks it was removed. It was seen that both feet were slightly swollen, the left showing the greater degree of swelling. There was no tenderness over the fracture site, or elsewhere. Another roentgenogram showed very definitely the fracture of the shaft of the second metatarsal with abundant callus formation. (Fig. 2.)

She was advised to begin walking with a split shoe and crutches and to use warm baths, massage, and exercises to the foot at home. The foot quickly became normal and she was successfully delivered at term. Since then she has had no further trouble with her foot.

The use of the walking cast in this case represents, I believe, an improvement in treatment over those forms previously described. After the first few days this patient was quite comfortable and walked everywhere without any other support. Walking on the cast stimulates callus and keeps the joints from getting stiff. It also tends to prevent osteoporosis.

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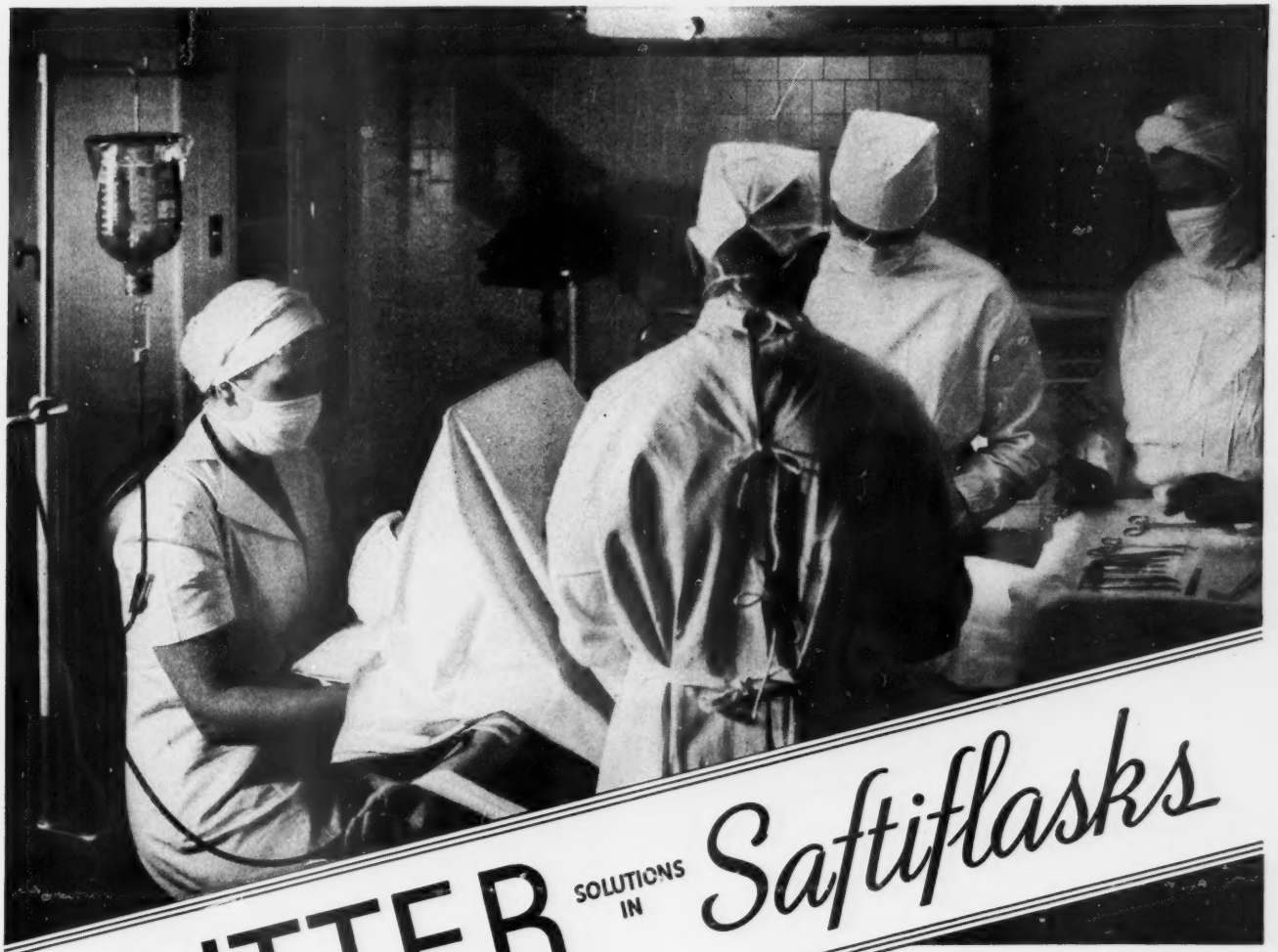

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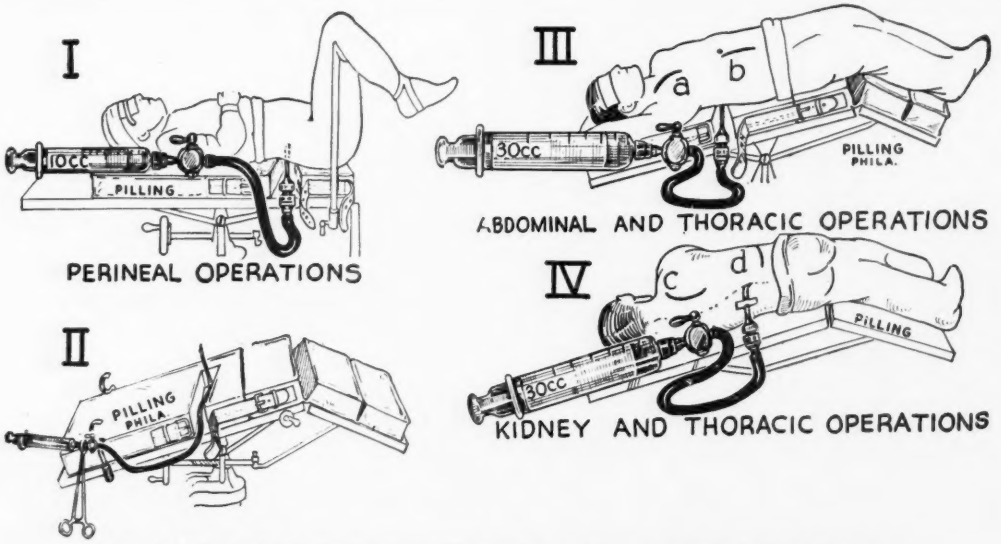

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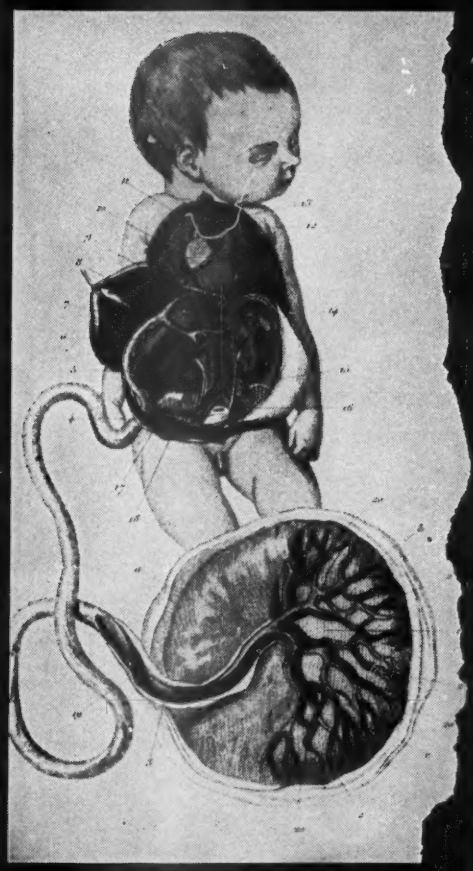

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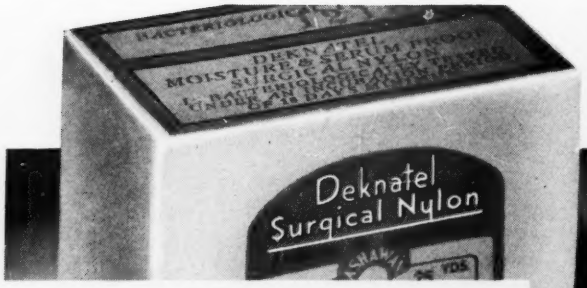

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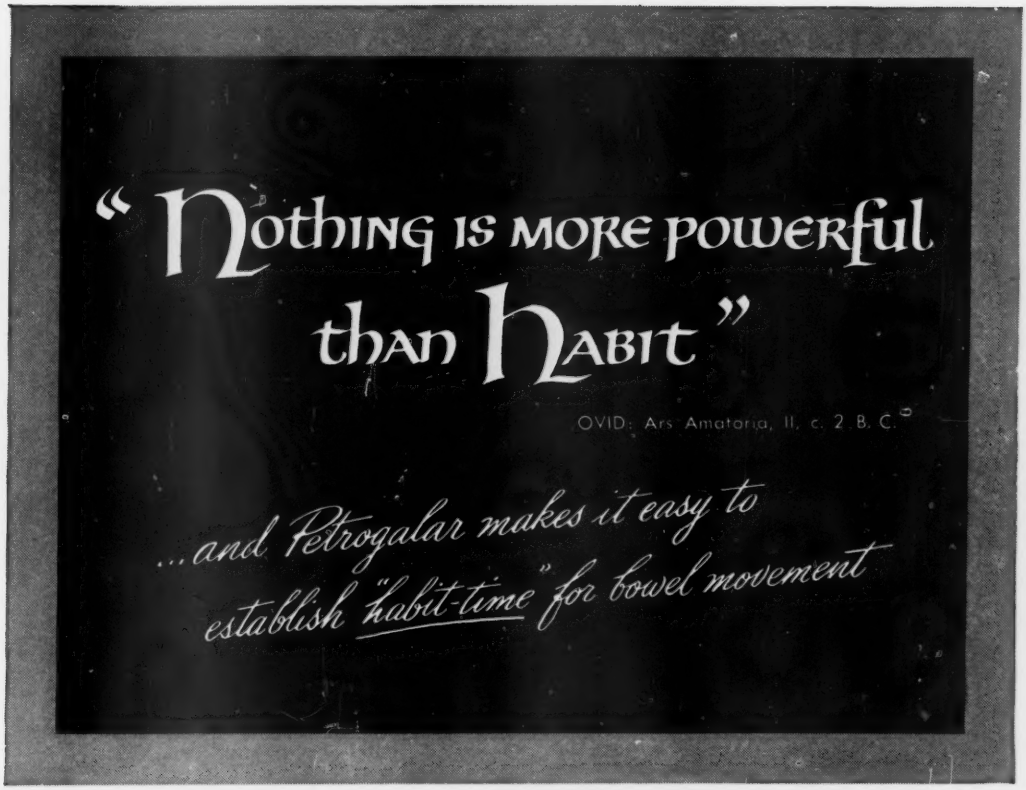
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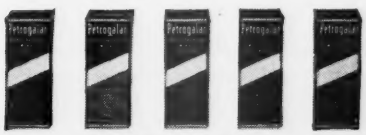

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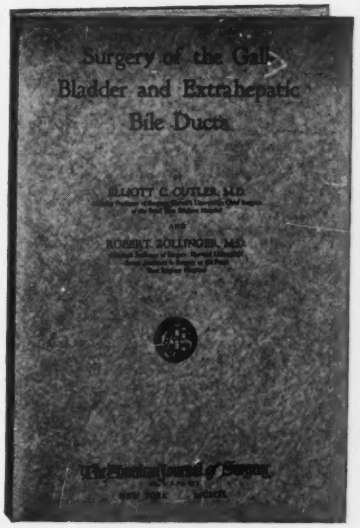

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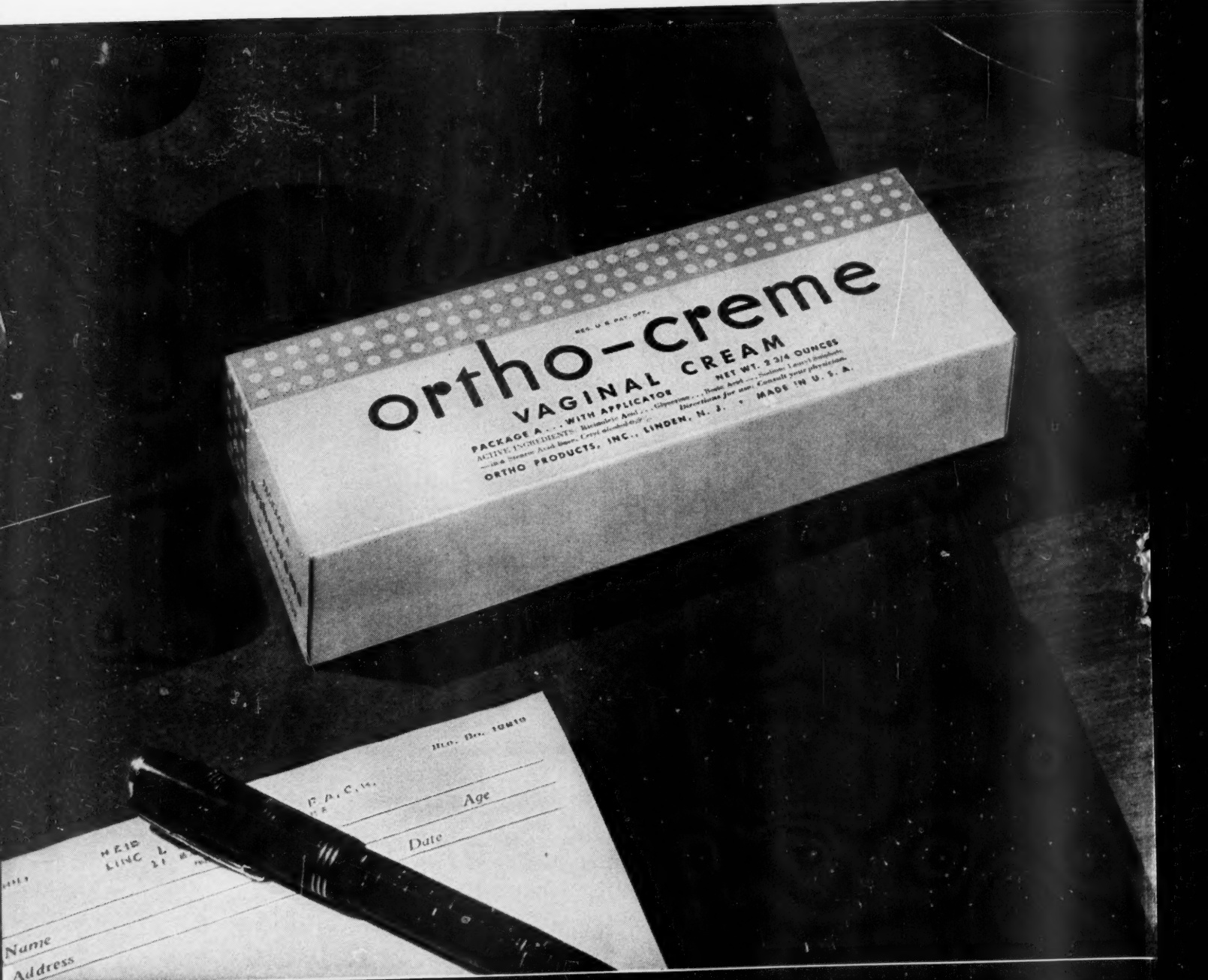

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